CROSSOSOMA

SOUTHERN CALIFORNIA BOTANISTS
Rancho Santa Ana Botanic Garden, Claremont CA. 91711

Crossosoma Vol. 8, No. 1 February, 1982
Editors: B. Hoshizaki and
M. Chesebro

WHITE ALDER (Alnus rhombifolia) REGROWTH FOLLOWING 1968-69 FLOODS

by Michael C. Long

Introduction

During the winter of 1968-69, southern California experienced unusually heavy rainfall with flooding in many foothill canyons of the San Gabriel Mountains. Rainfall data for Eaton Wash Dam at 902 feet elevation, near Altadena, indicates precipitation about 100 % above the normal for the 1968-69 season. Total rainfall for the season was 40.59 inches (103.10cm) with the 90-year normal rainfall being 20.43 inches (51.89cm).

Arroyo Seco, about 5 air miles west of Eaton Wash, experienced similar heavy rainfall and flooding. The canyon bottom was drastically altered by the floodwaters and moving debris and in several places along the stream large stands of white alders (Alnus rhombifolia) were completely destroyed by the floodwaters. Visits to the canyon in mid-February of 1969 verified the extent of damage. On successive visits over the next few years, the regrowth of streamside vegetation was observed and, in particular, the reappearance of alders in stands along the streamside was noted. After several years of regrowth and with the precise age of the young stands being known, it was thought desirable to take measurements to determine the rate of regrowth after flood for the alders.

Methods

White alder stands were sampled in Arroyo Seco Canyon, in the foothills of the San Gabriel Mountains above La Canada, on January 2, 1977 (participants included Steven Bonzo, Colin Fagan, Michael Haradon, and Michael Long). Two representative stands of alders, about 0.25 miles and 0.75 miles, respectively, up-stream from the U. S. Forest Service ranger residence were sampled. Elevation for the stands ranged from 1220 feet to 1310 feet. One-hundred trees

in each of the two stands were sampled at random by walking through the length of the stand parallel to the stream. For each tree the circumference (in cm to the nearest 0.5 cm) was measured at 4.5 feet above the ground (D.B.H.) using steel tapes. The circumference of each tree was divided by Pi (3.14) to determine diameter. The minimum and maximum height for each stand was determined with an

Summary of measurements - White Alders (*Alnus rhombifolia*), eight-year old stands,

Arroyo Seco, San Gabriel Mountains, Los Angeles County, California

	Location	N	Diameter (cm), mean (stand. dev.)	Range (cm)	Stand Height (m), min.	Stand Height (m), max.
Stand 1	0.25 mi. N. of U.S.F.S. ranger residence	100	11.83 (5.17) (=4.66 inches)	2.7 - 30.7 (1.06 - 12.09in.)	6.7 (28.5 ft.)	9.7 (31.7 ft.)
Stand 2	0.75 mi. N. of U.S.F.S. ranger residence	100	10.31 (4.66) (=4.06 inches)	2.7 - 19.4 (1.06 - 7.64 in.)	12.6 (41.3 ft.)	13.4 (43.9 ft.)
Combined total		200	grand $\bar{x}$ = 11.07 (4.92) (4.36 inches)	2.7 - 30.7 (1.06 - 12.09 in.)	6.7 (28.5 ft.)	13.4 (43.9 ft.)

Abney Hand Level (Dietzgen Co.) by sighting on the tops of the shortest and tallest trees in the stand, respectively. From the angle of slope thus measured and the distance from the observer to the base of the tree, the height was calculated by use of the Pythagorean Theorem. The mean diameter, range and standard deviation were computed for each stand and for the two stands combined.

Results

The mean diameter for all 200 trees measured in both stands is 11.07 cm (4.36 inches), see table. The smallest trees measured were 2.7 cm (1.06 inches) in diameter and the largest were 30.7 cm (12.09 inches) in diameter. Discarding the smallest trees measured as undoubtedly very young secondary growth within the somewhat older stands, the largest trees should indicate maximum growth for the eight-year period (1968-69 to 1976-77).

Thus the maximum growth in diameter per year is 3.84 cm (1.51 inches), with the mean increase per year being 1.38 cm (0.55 inches). The maximum growth in height per year using the tallest trees measured is 1.7 m (5.5 feet).

Sudworth (Forest Trees of the Pacific Slope, 1908, pg. 266) discusses growth in white alder and under "Longevity" he indicates: "Little is known of the age limits. Trees from 12 to 15 inches in diameter are from 37 to 50 years old." The largest trees measured in our 8-year old stand equal the smallest trees cited by Sudworth as 37 years old. Several factors may explain this apparent discrepancy. First, in our stands trees over 20 cm (7.9 inches) in diameter were rare (8 of 200 trees = 4%). Second, it was obvious that many of the trees we measured were re-growing from existing root systems not destroyed by flood. This should provide for more rapid growth than trees established from seed. Finally, growth rate should slow dramatically as the trees reach larger size. Thus the mean diameter of 11.07 cm (or 4.36 inches) may represent the best measure of growth in an 8-year old alder stand and this figure is within reason when compared with older trees cited by Sudworth.

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S.C.B. HIGHLIGHTS OF 1981

The year was another one of growth and achievement for S.C.B.

For the statistical game, we had 271 members at the beginning of 1980 and 405 members by December, 1981. Our book sales in 1981 were $8,246. Our April, 1981 plant sale grossed $2,081. Our dues and receipts covered our expenses.

We had our seventh all-day Symposium. This year the subject was "Cacti and Succulents" which we co-sponsored with California

State University, Fullerton. It was in honor of Dr. Lyman Benson who was present and provided introductory and concluding remarks. He was delighted with the day, as were all who attended.

We continued our contributions to activities significant to our society, providing a total of $1,000. to the Symposium and to The Nature Conservancy projects at Baldwin Lake and the Jepson Prairie Preserve.

We initiated a new Student Research Grant Program and awarded our first two grants, as reported in this issue. We have a fine start on this new worthy program.

We again awarded a prize of $100. for the best botany paper at the Southern California Academy of Science's annual meeting. Suzanne Goode was the recepient with her paper on The Vegetation of La Jolla Valley. She will lead a field trip there for us on Saturday, May 1, 1982.

Another first is the issuance of "The Flora of the Higher Ranges and the Kelso Dunes of the Eastern Mojave Desert in California." It appears as part of the October, 1981 issue of ALISO, but we purchased 300 sets of sheets of the Flora and provided a cover, so that it is available as a separate publication. Our investment is substantial, but we believe it will have wide acceptance and use.

Our Field Trips included Big Bear Lake and Baldwin Lake, a Fungus Foray to Placerita Canyon, Starr Ranch in Orange County, Granite Mountains, and to Sequoia National Park where we observed a rather awesome controlled burn. We also found Drosera in the one wet meadow with an acid pH.

One innovation was a bryophyte trip to the West Fork of the San Gabriel River. This was a most successful search for mosses in a very beautiful canyon. Our bryologist leaders were delighted with our members who found some species new to the area.

We again made two field trips to Baja California. The first was to the northern mountains and the Gulf Coast. The second was to the wild and remote area of cave paintings west of Guerrero Negro. This was a six day trek. Gear was transported on mules.

We again published six issues of CROSSOSOMA and featured original, unpublished botanical studies as lead articles.

Please send your dues promptly and join us in our 1982 projects.

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BOTANICAL BOOKS AVAILABLE

SCB maintains a substantial stock of books for sale at a 10% discount to members. We have technical and popular books, including many floras.

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777 Silver Spur Road (Suite 111)
Rolling Hills Estates, California 90274

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STUDENT RESEARCH GRANTS

In the October, 1981 CROSSOSOMA, we announced our new program of grants for student research. The Board has approved our first two grants.

Sherman Lambert, a graduate student at University of California Irvine, will use the data base of permanent plots in Sequoia National Park, established between 1965 - 1968, to construct life tables of mixed conifer species and to test three hypotheses basic to forest succession. He will use his knowledge of computer programming to carry out a combined field-simulation study of successional processes in this forest. Professor Philip W. Rundel states "Such types of studies using the sophisticated types of models he is now developing have not been carried out in the western United States. They show very real promise for providing a much improved basis for interpreting the relative importance of stochastic and deterministic forces in shaping the structure and species diversity of the forest types we see today."

Robert E. Fulton, a graduate student at California State University, Fullerton, has a project entitled "Reproductive Ecology of Agave deserti in the Presence and Absence of Coevolved Bat Pollinators." His Abstract states: "Pollination by bats has been demonstrated for species of Agave which show a paniculate flowering habit, and a syndrome of other characteristics conducive to bat visitation (Schaffer and Schaffer, 1977; Faegri and Van der Pijl, 1971). Agave deserti exhibits floral morphology and phenology strongly suggesting coevolution with bats as pollinators, yet its present distribution extends significantly northward beyond those of potential mammalian pollinators (Howell, 1972; Alverez and Gonzalez, 1970). Partial disparity between A. deserti distribution and that of its coevolved pollinator, provides a valuable opportunity to make apriori predictions about changes in plant and flower morphology and flowering phenology as selective forces shift away from bat pollination." He will collect data which test those predictions. The project will serve as a basis for his M.A. Thesis. Professor C. Eugene Jones, in recommending this project, reports: "If Agave can be used as a model system, any knowledge gained from this study should help gain a greater insight into the ability of a plant species to react to the loss of its coevolved pollinator and, therefore, to changing selective forces. To my knowledge no comparable studies have ever been attempted for plant-pollinator systems; thus, Rob's results could provide a foundation for further studies into this phenomonen. As disturbance in the environment continues, the association between pollinator and plant is frequently disrupted by the extinction (frequently caused by man's act-

ivities) of the pollination vector. Studies to determine what effects such extinctions have on the coevolved partner may shed greater light on potential ways of conserving the frequently endangered plant species."

Southern California Botanists plans to continue these grants as funds are available and will solicit applications from time to time.

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RESEARCH NATURAL AREAS (RNA's) IN NATIONAL FORESTS

The United States Forest Service now has a program for the establishment of Research Natural Areas (RNA's) and desires to have suggestions from those with field experience and professional judgement.

According to Forest Service policy, RNA's are established to (1) contribute to the preservation of examples of all significant natural ecosystems for purposes of scientific research and study; (2) provide gene pools; and (3) where appropriate, to protect habitats of rare and endangered species of plants and animals.

The Angeles National Forest is currently soliciting proposals for representatives of the following ecosystems:

White Fir	Pinyon-Juniper	Other Unique
Coast Live Oak	Coulter Pine-Chaparral	Ecosystems
Limber Pine	Bigcone Douglas Fir	

Research Natural Areas are supposed to represent unmodified conditions, with no evidence of major disturbances by man. However, due to the generally disturbed nature of most of the Southern California Forests, it may be necessary to consider areas that are less than "pristine". There are no firm restrictions on size of RNA's, but a minimum of 300 acres is desired. High quality areas of smaller size should not be disregarded, especially if they are the best or only representatives of a particular ecosystem or unique feature. Also, the case for a potential RNA may be reinforced if the area contains a combination of target elements (e.g., Limber Pine and a sensitive plant).

The emphasis in managing an RNA is to protect it from processes which may modify its natural integrity. The restrictions on public use are more rigid than in Wilderness Areas, with access more or less limited to scientists and educators. An RNA is withdrawn from mineral entry, timber harvest and most developed recreation. Dispersed recreational activities, such as hunting and hiking, are discouraged or prohibited. In some cases it is acceptable to manage the vegetation in an RNA. For example, it may be desirable to prescribe burn an RNA in which fire has been unnaturally excluded by man.

All proposed RNA's on the Angeles will be compared with similar sites on other Southern California Forests, and the "best" representative(s) will be chosen for further analysis. So, although we have Coast Live Oak on the Angeles, it is highly probable that the Los

Padres National Forest has larger, more representative, and more remote stands.

For any area you propose, you are asked to enclose a map or detailed description of its location, and describe all ecosystems and/or unique features present, including stress threatened, endangered or rare plants and animals that you know or suspect to be there. Also, include any other justifications for its possible establishment as an RNA, such as important wildlife values or the presence of unique geologic or cultural features.

Send your proposals to: United States Forest Service
150 S. Los Robles, Suite 300
Pasadena, California 91101
Attention: Anne Hiller, Biologist

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FIELD TRIPS AND EVENTS

February 27, 1982, Saturday, 9:30 A.M. Fungus Foray
San Dimas Canyon Park

Take Foothill Freeway (210) to San Dimas Ave. exit in San Dimas; go north on San Dimas Ave. 0.4 mi. to Foothill Blvd., then east on Foothill Blvd. 0.5 mi. to San Dimas Canyon Rd., then north on San Dimas Canyon Rd. 0.1 mi to San Dimas Canyon Park. Park near the west end of the Park and assemble at the edge of the parking lot. Orientation is at 9:30 A.M. Maps to suggested collecting areas in both canyons will be distributed.

Review: Reassemble at 1:00 P.M. at the orientation site (San Dimas Canyon Park) to display and review specimens. Experienced mycologist will be present to assist participants.

Bring collecting sack or basket, waxed paper, digging tool, knife and any field books you may have.

Leader: Florence Nishida.

March 3, 1982, Wednesday, 7:00 P.M. Lecture
San Diego Museum of Natural History

Dr. Robert Thorne and Dr. Reid Moran will talk on Desert Plants for one of the lectures in the San Diego Natural History Museum 1982 Seminar Series on The Desert. Lectures will be held at the Museum Auditorium 7-9:30 P.M. Single lectures $5.00. Phone (714) 232-3821 Ext. 203 for further information. The lecture series opens on February 10, 1982 and ends March 24, 1982.

March 6, 1982, Saturday, 9:00 A.M. Mosses in the West Fork
San Gabriel River Canyon

We will walk or may drive if we secure the Forest Service key, this beautiful canyon that leads to Cogswell Reservoir. The stream and vegetation are magnificent. North facing cliffs should reveal

an abundance of bryophytes. This is an unusual trip with competent bryologists as leaders. Leader: Judy Harpel.

Take San Bernardino Freeway (I-10) or Foothill Freeway (I-210) to Azusa Avenue (State 39); north on Azusa Ave. which becomes San Gabriel Canyon Road. Continue up the Canyon past the upper reservoir, bear left and meet at the bridge across West Fork of river. A hand lens is essential. Bring lunch and water.

March 27, 1982, Saturday, 9:00 A.M. to 6:30 P.M.
Wetlands Symposium.

This Symposium is sponsored by the American Cetacean Society and will be at the New Cabrillo Museum, Cabrillo Beach, San Pedro, California.

March 28, 1982, Sunday, 11:00 A.M. Annual Desert Garden Walk, Fish Creek in Anza Borrego Desert State Park.

This event is sponsored by the Desert Protective Council. To get to Fish Creek, take Highway 78 and turn south at Ocotillo Wells onto Split Mtn. Rd. Fish Creek is 8.2 miles from the Highway 78 turn off. From Borrego Springs to Fish Creek is 28 miles and from Scissors Crossing (at Highway 78 and Highway 52) it is 31 miles to Fish Creek. There is no charge to attend.

Leaders will be Dr. Richard Phillips, Environmental Studies and Geology at U.S.D., Mitchell Beauchamp, California Native Plant Society botanist, Paul Jorgenson, Park Naturalist and Park Rangers. Further information is available at the Park office (714) 767-5311. Committee members can be reached at (714) 755-0826 and (714) 583-8486.

April 3, 1982, Saturday, 8:00 A.M., Native Plant Sale.
Rancho Santa Ana Botanic Garden, 1500 North College Ave., Claremont

This will be our eighth annual sale of California natives. We have a good stock from the R.S.A. collection plus selections from commercial growers. There is usually a crowd of buyers at the opening and the choice plants go fast.

We will also have a wide assortment of botanical books for sale.

We need S.C.B. volunteers to help. Please be there before 8:00 A.M.

Combine the sale with a visit to the garden - eighty acres of natives with many at peak bloom.

April 2, Friday or April 3, Saturday to April 11, 1982
Easter vacation trip to Baja California.

Walt Wright is leading this trip. Send him a self-addressed and stamped envelope and he will mail the details to you. His address is 326 Redwood Ave., Brea, California 92621

April 17 - 18, 1982, Saturday and Sunday, Canoe Trip Topock Gorge

For details, again send self-addressed, stamped envelope to Walt Wright, 326 Redwood Ave., Brea, California 92621

April 23, 24 and 25, 1982, Friday, Saturday and Sunday Catalina Island

For details, again send self-addressed, stamped envelope to Walt Wright, 326 Redwood Ave., Brea, California 92621

April 30, Friday - May 5, 1982 Wednesday, Guadalupe Island and Cedros Island, Baja California, Mexico.

Mitch Beauchamp and San Diego Chapter of C.N.P.'s have arranged this trip. Mitch will lead. Last year the Palm Society went to Guadalupe Island to see the Brahea edulis. This year the trip also includes Cedros Island. Both are difficult to visit. The cost is $565.50 including all meals, permits, etc.

To reserve space, send $100.00 deposit to H & M Landing, 2803 Emerson St., San Diego, Calif. 92106. For more information call Anne Mac Evitt (714) 226-8224. Trip limited to 32 people.

April 30 and May 1, 1982, Friday and Saturday, 9:00 A.M., Southern California Academy of Science Annual Meeting at California State University, Dominguez Hills, Carson.

Send abstracts by March 1, 1982 to Dr. Gus Mc Carthy, Department of Biology, California State University, Dominguez Hills, Carson, California 90747.

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California Coastal Access Guide by the California Coastal Commission (University of California, 1981. $7.95; illustrated)

This complete, new guide identifies and describes, county by county, the scenic and recreational facilities of the coast of California and gives directions for access and use. Although private property can extend to a beach, the beach itself, beyond the mean high tide lines - the wet sand part of the beach - is open to everyone. This book, with detailed maps and photographs, describes beaches and tidal areas and locates parks, piers, stairways and the like which provide access. How to reach beaches by private as well as public transportation is indicated and access for the disabled is shown. Recreational facilities of each site are described and appropriate use and protection of sensitive habitats is discussed. There are feature articles on such subjects as waves and tides, dunes, vegetation and wildlife, hostels, safety, surfing, diving, clamming and bicycling.

Hiking in Topanga State Park by Milt McAuley, 1981. (Canyon Publishing Company, 8561 Eatough Avenue, Canoga Park, Ca 91304. $5.95)

This splendid book with its maps of hiking trails in Topanga State Park describes the network of trails and fire roads for travel on foot, horseback or non-motorized vehicle. 21 trail heads to the park are given and the trials are meticulously laid out. Their length, distinguishing features (level or steep and elevation) and points of interest to be noted along the way are provided. Topography, geology, animal life and plant life with its five distinct communities (chaparral, oak woodlands, riparian woodlands, grasslands and coastal sage scrub) are well described. The history of the area is discussed. Environmental hazards - getting lost, fire, sun, rain and flood, ticks, insects, reptiles, poisonous plants and possible contaminated drinking water (carry your own or drink only from a faucet).

Hiking Trails of the Santa Monica Mountains by the same author (1980) covers the larger area in a similar way. ($8.95)

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A FLORA OF THE HIGHER RANGES AND THE KELSO DUNES OF THE EASTERN MOJAVE DESERT IN CALIFORNIA

The December, 1981 issue of CROSSOSOMA announced our issuance of this Flora as a separate volume. It was originally published in the October, 1981 issue of ALISO.

The Flora is 115 pages and deals with the climate, the geology, the history of plant collecting in the area (commencing with T. S. Brandegee in 1902 and Marcus E. Jones in 1906), the plant communities, the phytogeographical relationships of the flora, the biological spectrum, and it contains a catalogue and an annotated check list of the vascular plants.

In 1973, R. F. Thorne and J. Henrickson began active collecting for this flora. Since that time the three authors have each made thousands of collections in the eastern ranges, independently or often jointly or with their associates. It is estimated that 10,000 to 12,000 collections from these ranges have been studied for this flora.

Our volume is now ready. The price is $7.00 to all, including sales tax and mailing. Send your order and check to:

S.C.B. Booksales, C/O Gardner
777 Silver Spur Road (111)
Rolling Hills Estates, California 90274

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DENDROCHRONOLOGY IN THE ART MUSEUM

A recent lecture at the J. Paul Getty Museum entitled "Insights into Paintings of Tudor Times through Wood Technology" related the use of tree ring dating (dendrochronology) to art work. John Fletcher of Oxford University, the speaker, has successfully used tree ring dating on 90% of the 250 oak panel paintings investigated.

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DELINQUENT DUES

Please check the year on your address label. If it indicates '82, you are current. Otherwise, you are delinquent and your check will be appreciated. Due to mailing costs, we are shortly dropping all those who are delinquent.

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We thank all those who promptly remitted their 1982 dues. All others please send your checks. This Journal can only be sent to members whose dues are current.

COMING 1982 EVENTS (DETAILS WITHIN)

February 27	SCB Fungus Foray, San Dimas, 9:30 A.M.
March 3	Desert Plant lecture, San Diego, 7:00 P.M.
March 6	Moss trip, West Fork San Gabriel Canyon, 9:00 A.M.
March 27	Wetlands Symposium, San Pedro, 9:00 A.M. - 6:30 P.M.
March 28	Desert Walk, Anza Borrego, 11:00 A.M.
April 2/3-11	SCB Baja California trip.
April 3	SCB Plant Sale, Claremont, 8:00 A.M.
April 17-18	SCB Topock Gorge Canoe trip.
April 23-25	SCB Catalina trip.
April 30-May 1	S.C.Academy of Science Annual Mtg., Dominguez Hills.
April 30-May 5	Islands of Baja California.

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Editors: C. Eugene Jones
Trudy Ericson

FLORAL COLOR CHANGES IN DEERWEED (Lotus scoparius): POSSIBLE FUNCTION

by

C. Eugene Jones and Mitch Cruzan

Have you ever wondered why some of our beautiful wildflowers change color with age? In such species the petals of the spent (normally already pollinated) flowers are not dropped from the flower but are maintained on the plant for some time even though they are no longer visited by the pollination vectors. What selective advantage might accrue to plants that maintain their flowers past the pollination event, since this maintenance must cost the plant energy? Floral color changes, like those described above, are just one example of post-pollination floral changes.

The first concise hypothesis regarding the potential biological significance of post-pollination floral color change was apparently formulated by Fritz Müller in a letter to the editor of Nature, Charles Darwin, in 1877 (Müller, 1877). In discussing the color changes in Lantana, he stated, "If the flowers fell off at the end of the first day, the inflorescence would be much less conspicuous; if they did not change their colour much time would be lost by the butterflies inserting their proboscis in already fertilised flowers" (Müller, 1877). The first data that we have been able to uncover regarding bee behavior and floral color change were published in 1883 (Müller, 1883). Recently the phenomena related to post-pollination floral changes have received greater attention (see Gori, 1982, for a review of the subject). Our study was initiated to examine the dual pronged hypothesis that the maintenance of spent flowers on deerweed [Lotus scoparius (Nutt in T. & G.) Ottley ssp. scoparius] increases the floral color display (i.e., the long-distance orientation cue) attracting more pollinators and therefore increasing the probability of further successful pollinations (and fertilizations) of the remaining virgin flowers on the same plant. This assumes that such a mechanism will increase fruit

set and thus seed production, while at the same time increasing the energetic efficiency of reward (e.g., nectar and pollen) harvesting by the pollination vectors.

A post-pollination change can be defined as any relatively rapid morphological change in a flower that is initiated during the process of pollination and prior to fertilization. Such changes result in these flowers becoming less conspicuous and/or less accessible to pollination vectors. Besides changes in floral colors, they may also include the cessation of odor production, changes in the position or orientation of floral parts or the entire flower, or the abscission of certain floral parts.

Deerweed is a rounded, relatively small, perennial in the legume family (Fabaceae), which is often rather woody at the base. It is a common plant of disturbed or post-fire successional habitats below 5000 feet throughout much of cismontane Southern California. The flowers are borne in few-flowered axillary umbels (Munz, 1974). Apis mellifera, the common honeybee, is the dominant pollinator, although it is pollinated by several species of native bees (unpublished data). The flowers are small and initially yellow. Following pollination the banner petal turns orange and folds down over the keel.

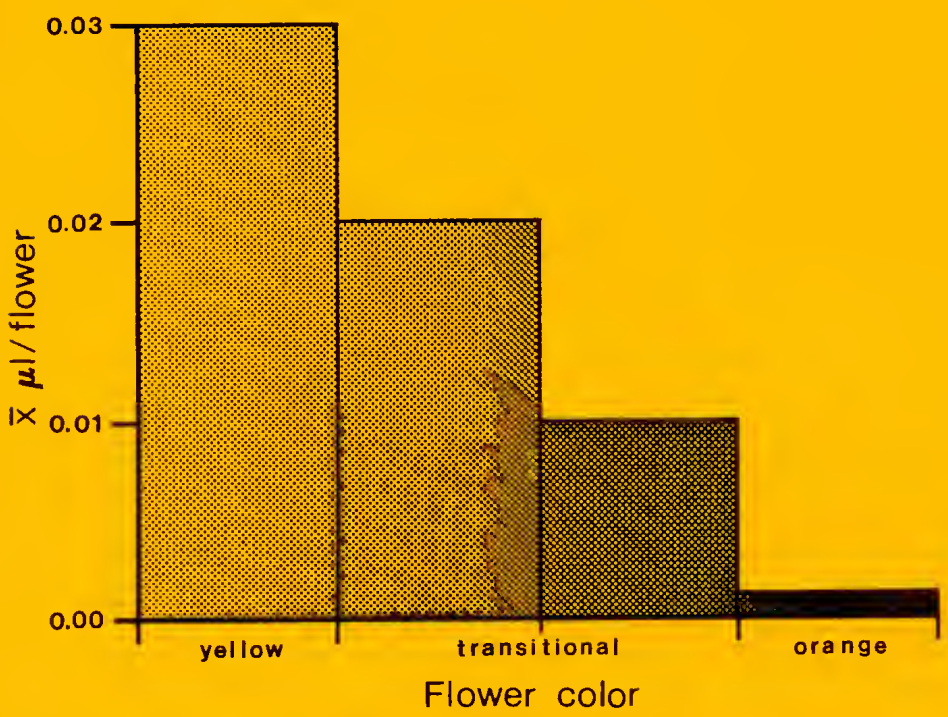

Figure 1. Nectar in pre- and post-pollinated flowers

With these morphological changes there is a dramatic and significant ($P < 0.001$) decrease in the amount of nectar that is available per flower (Figure 1). Furthermore, by the time the floral color has turned orange all pollen has been removed from the anthers. As can be seen in Figures 2 and 3, the morphological changes in position of the banner petal and floral color occur with senescence, but occur much faster with pollination.

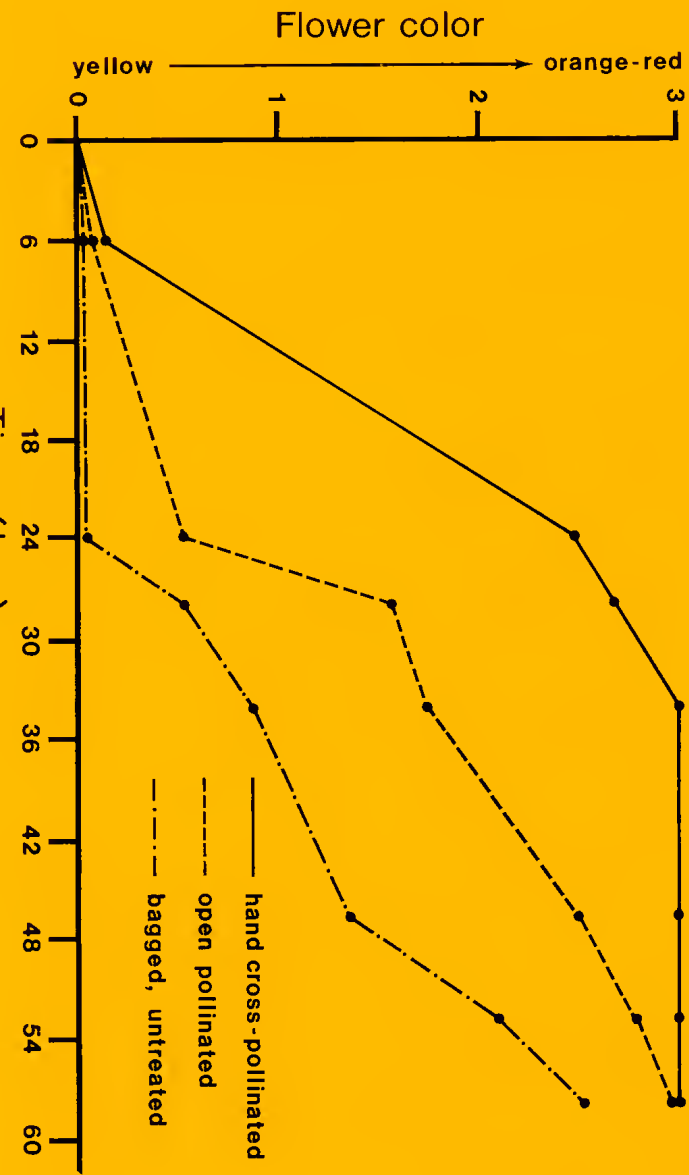

Figure 2. Color change with and without pollination

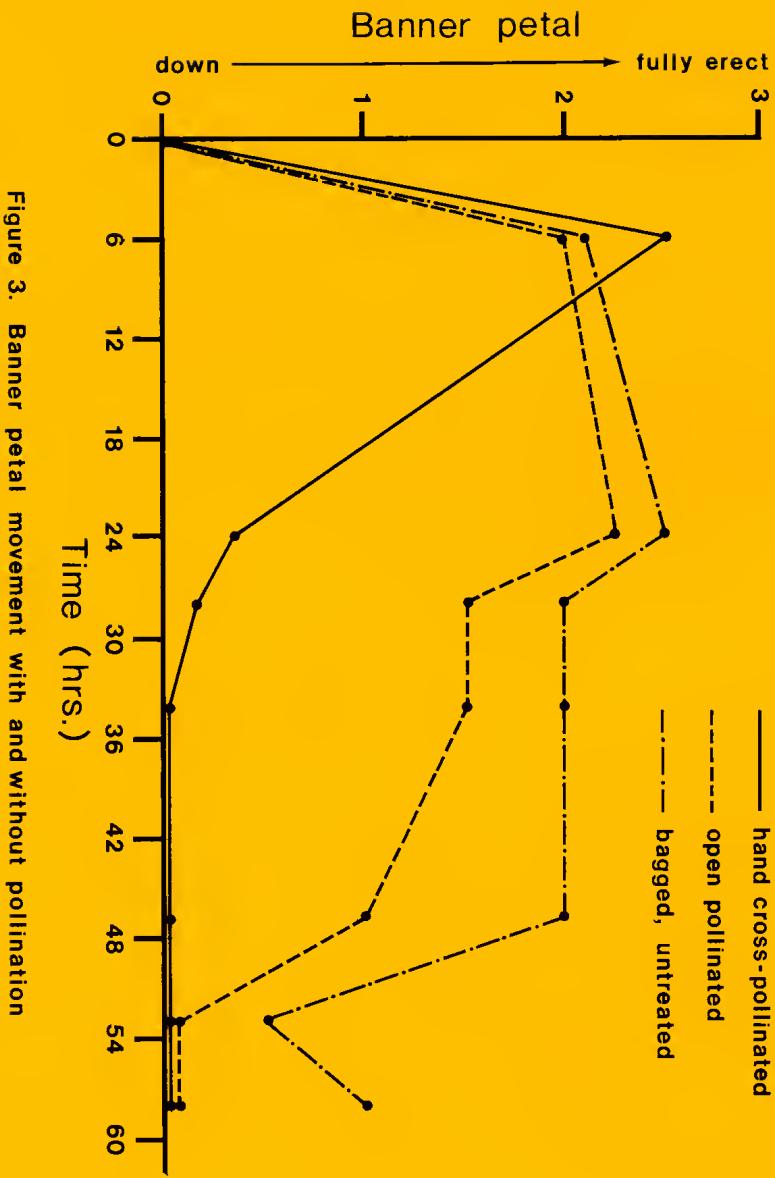

Figure 3. Banner petal movement with and without pollination

Our next step was to see if the bees visiting deerweed could distinguish the yellow from the orange flowers. As can be seen in Table 1 the bees visited and pollinated significantly more yellow than orange flowers (using a Chi-square goodness of fit test, Sokal and Rohlf, 1969). These data allowed us to reject the null hypothesis that bee visitation is independent of flower coloration.

Table 1. Bee visitations to pre- (yellow) and post-pollinated (orange-red) flowers.

	Pollinations of Yellow Flowers	Pollinations of Orange and Red Flowers
Observed	2334	51
Expected	859	1526

H_o = Bee visitation is independent of flower coloration.

$\chi^2 = 3958.45$; $P < 0.001$

We then proceeded to investigate whether or not the presence of flowers in post-pollinated condition influenced the frequency of bee visitations to deerweed. Our data here are only preliminary and we hope to collect more data this spring related to this portion of our hypothesis. In order to do this we took two plants. Plant 1 was not modified in any way. Plant 2 had all the orange colored flowers removed. Both plants had approximately the same number of yellow flowers. The idea here is that if orange flowers have no effect on bee attraction to the plant, then removing them should not reduce the number of bee visits to the yellow flowers left on Plant 2. However, as can be seen in Table 2, there was a significant difference in the number of pollination visits to Plant 1 versus Plant 2 (again using a Chi-square goodness of fit test). To our knowledge these are the first data to be published showing this effect of the maintenance of flowers in the post-pollinated condition on plants.

Table 2. Bee visitations to plant with both pre- and post-pollinated flowers vs. plant with only pre-pollinated flowers.

	Total Pollinations of Plant with both Pre- and Post-pollinated Flowers	Total Pollinations of Plant with only Pre-Pollinated Flowers
Observed	145	23
Expected	84	84

H_o = Presence of post-pollinated flowers does not influence the frequency of bee visitations.

$\chi^2 = 88.6$; $P < 0.001$.

Besides collecting more data related to the significance of maintaining of the orange floral morphs, we also hope to set up experiments this spring which will help us determine if the maintenance of flowers in the post-pollinated condition increases fruit and therefore seed set in deerweed. Other interesting questions also seem to deserve investigation. For example, why do some plants have post-pollination changes, whereas others do not? Is the presence of such changes correlated with ecological strategy or habitat? So, although these floral changes have been known for over 100 years, studies are only now beginning to unravel the biological significance of these related phenomena.

* * * * * * *

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COMPARISON OF TWO SENSITIVE SPECIES OF THE LOCOWEED, ASTRAGALUS, IN THE ALGODONES DUNES

by

ALAN ROMSPERT

During 1978 and 1979, seven species of sensitive plants were investigated in the Algondones Dunes of Imperial County, California by myself and Dr. Jack Burk (Calif. State Univ. Fullerton) for the Bureau of Land Management Desert Planning Staff. Two of these species belong to the genus Astragalus in the family Fabaceae. While belonging to the same genus, the morphology, phenology and adaptive strategy of these two species is quite different.

One species, Astragalus lentigenosus borreganus, occurs predominantly along the east side of the dunes where flooding from the Chocolate Mountains and Cargo Muchachos forms hard mud flats which hold water after periods of heavy precipitation. The other species, Astragalus magdalenae peirsonii, is found mainly on the western and central portion of the dunes in sandy valleys and low dunes.

The morphological differences between the two sensitive species of Astragalus in the Algondones Dunes are small. When considering the close taxonomic association and the similar environmental stresses placed upon the two species, great dissimilarity would not be expected. The major differences are the gross morphology of the plants, the leaf morphology and the morphology of the legumes. Table 1 presents a comparison of the morphological characteristics of the two species.

Seeds of both species had germinated and their seedlings were observed in December. Some of these seedlings became reproductive in only one month (A. magdalenae peirsonii) or three months (A. lentiginosus borreganus) and flowered as winter annuals. However, it was the older plants which produced the bulk of the yearly seed crop. Seeds for both species appeared to be dispersed in April.

The mode of seed dispersal is quite different for the two species due to the morphology of the pod in which the seeds develop. Astragalus magdalenae peirsonii has an inflated pod with light, papery-thin valves, which is blown across the dunes disseminating its seed cargo. Drifts of pods, either empty or with a few remaining seeds, can be found in depressions or trapped by the branches of another plant. In contrast, the pod of Astragalus lentigenosus borreganus is not strongly inflated but has valves that are thick and leathery. The more lance-acuminate shape and greater weight of these pods reduces the distance the seeds can be disseminated by abiotic factors.

The morphological difference in the pods of the two sensitive species of Astragalus may have some influence on the impact of an

TABLE 1

MORPHOLOGICAL CHARACTERISTICS OF TWO SPECIES OF *ASTRAGALUS*.

Astragalus magdalenae peirsonii	*Astragalus lentigenosus borreganus*
Stout perennial of short duration	Plants annual or biennial
Some bloom as winter annual	Bloom as winter annual or biennial
Caulescent herb, at length wood below	Plant erect caulescent herb
Stems erect, 2-7 dm high	Several stems from taproot, 3-5 dm high
Hairs basifixed, hoary, strigose, appressed	Hairs basifixed, hoary, strigulose, appressed
Leaves compound, unequally pinnate, alternate, 5-15 cm long, broad flat rachis, 8-12 folded lateral leaflets, terminal leaflet decurrent and continuous with the rachis, with short leafy spurs in lower axils	Leaves compound, unequally pinnate, alternate, 5-10 cm long, 7-15 oblong leaflets, leaflets 6-12 mm long
Stipules present and free	Stipules present and free
Inflorescence axillary and racemose	Inflorescence axillary and racemose. Racemes loose, open, elongated
Peduncles 7-10 cm long	Peduncles 3-10 cm long
Flowers perfect, irregular (papilionaceous), 10-17 in raceme	Flowers perfect, irregular (papilionaceous)
Calyx 5 toothed, 5-9 mm long, tube 3.5-4 mm long, teeth 1.5-5 mm long, hypogynous	Calyx 5 toothed, hypogynous, tube cylindrical 5 mm long, teeth 1 mm long
Petals 5, papilionaceous (banner or standard, wings, keel of 2 petals united), banner 10-14 mm long, keel muticous (blunt tipped), dull purple, hypogynous	Petals 5, papilionaceous (banner or standard, wings, keel of 2 petals united), banner 10-12 mm long, keel 8.5 mm or more long, not beaked (muticous), purple, hypogynous
Stamens diadelphous (9+1 arrangement)	Stamens diadelphous (9+1 arrangement)
Pistil simple, free	Pistil simple, free
Ovary superior	Ovary superior
Style glabrous	Style glabrous
Fruit called a legume (a dehiscent 2 valved pod)	Fruit called a legume (a dehiscent 2 valved pod)
Pods strongly inflated (bladdery), 20-35 mm long, sessile, spreading, ellipsoid, with short deltoid beak	Pods not strongly inflated, 12-18 mm long, 4-5 mm thick, sessile, lance-acuminate in profile, somewhat obcompressed, abruptly deltoid-beaked
Valves papery, strigulose	Valves leathery, strigulose, inflex as complete septum
Seeds germinate at 15 & 25°C but not at 30 or 35°C	Data not available

insect predator. A beetle of the Bruchidae family lays its eggs on the embryos of these species. The growing larvae consumes a portion of the seeds before metamorphosing into the new generation of adult beetles. The impact of this predator is greater on Astragalus magdalenae peirsonii (personal observation), possibly due to the thinner valves.

Astragalus lentigenosus borreganus shows meristematic activity during most of the year with accelerated rates producing great stem elongations in October and November, before the reproductive cycle begins. It is during this period of increased meristematic activity, with increased sap flow, that a snout beetle (weevil) of the family Curculionidae, subfamily Apioninae, appears to act as a predator on dune vegetation. Astragalus lentigenosus borreganus is one of the most heavily predated species in the dunes (unpublished data). This could be due to the more herbaceous morphology of this species.

Astragalus magdalenae peirsonii begins meristematic activity in November and continues through May. In July, with the absence of summer rains, most plants became drought deciduous and dropped all their leaves until the beginning of the meristematic activity in November. The ability to express drought deciduousness by A. m. peirsonii confers an advantage on this species not available to A. l. borreganus in conserving water.

While both species bloom during the winter months, the duration of the reproductive period is markedly shorter in A. l. borreganus. Reproductive buds and inflorescences were present in both species in December. By April A. l. borreganus had completed its reproductive cycle and the biennial plants had died. In contrast, A. m. peirsonii continued its reproductive cycle into May with seeds still being dispersed in June, at which time the plants are in a vegetative state. Thus, one of the species of Astragalus has individuals which contribute seeds to the gene pool more than once, whereas the other produces seeds only one time.

FIELD TRIPS AND EVENTS

April 3, 1982, Saturday, 8:00 a.m., Native Plant Sale. Rancho Santa Ana Botanic Garden, 1500 North College Ave., Claremont.

This will be our eighth annual sale of California natives. We have a good stock from the R.S.A. collection plus selections from commercial growers. There is usually a crowd of buyers at the opening and the choice plants go fast.

We will also have a wide assortment of botanical books for sale.

We need S.C.B. volunteers to help. Please be there before 8:00 a.m.

Combine the sale with a visit to the garden - eighty acres of natives with many at peak bloom.

April 2, Friday to April 11, 1982
Easter vacation trip to Baja California.

Walt Wright is leading this trip, going all the way to Cabo San Lucas. Send him a self-addressed and stamped envelope and he will mail the details to you. His address is 326 Redwood Avenue, Brea, California 92621. The plan is to drive up to 150 miles per day. You may leave the trip at any point and return on your own.

April 17 - 18, 1982, Saturday and Sunday
Canoe Trip, Topock Gorge

For details, again send self-addressed, stamped envelope to Walt Wright, 326 Redwood Avenue, Brea, California 92621.

April 23, 24 and 25, 1982, Friday, Saturday and Sunday
Catalina Island

For details, again send self-addressed, stamped envelope to Walt Wright, 326 Redwood Avenue, Brea, California 92621. Reservations are required. We will camp at Cherry Cove.

April 30 and May 1, 1982, Friday and Saturday
Southern California Academy of Science Annual Meeting.

At California State University, Dominguez Hills, Carson, starting at 9:00 a.m.

May 8 and 9, 1982, Saturday and Sunday
La Jolla Canyon, Mugu State Park

Meet at 9:00 a.m. Saturday at the unmarked parking lot for La Jolla Canyon, opposite the beach campground of Mugu State Park, about one mile north of Sycamore Canyon on Highway 1 (about 40 miles north of Santa Monica). We will walk two miles to reach the Canyon and will walk a total of seven miles on Saturday. Those who wish to stay over-night and continue on Sunday, will camp in the Canyon, at the beach or at McGrath State Park, north of Oxnard. Leader is Suzanne Goode, whose Master's Thesis was on the vegetation of the Canyon.

May 14, Friday - May 19, 1982 Wednesday, Guadalupe Island, San Martin Island and Todos Santos Island, Baja California, Mexico.

Mitch Beauchamp and San Diego Chapter of C.N.P.S. arranged this trip. Mitch will lead. Last year the Palm Society went to Guadalupe Island to see the *Brahea edulis*. This year the trip includes San Martin Island and Todos Santos Island. The cost is $535.00 including all meals, permits, etc. The April 30 - May 5 trip which included Cedros Island has been cancelled.

To reserve space, send $100.00 deposit to H & M Landing, 2803 Emerson Street, San Diego, California 92106. For more information call Anne Mac Evitt (714) 226-8224. Trip limited to 32 people.

May 15 and 16, 1982, Saturday and Sunday
Vernal Pools of San Joaquin Valley

Walt Wright is also planning this trip. Send your self-addressed, stamped envelope to him for details.

May 21-23, 1982, Friday to Sunday
San Miguel Island and Anacapa Islands

A trip sponsored by the American Cetacean Society. Cost $140.00 for boat, five meals, etc. Spend whole day on each island with park naturalist. See tremendous variety of marine mammals. Call March at (213) 439-9554.

May 23, 1982, Sunday, Algal Tide Pool Walk, 1:30 p.m.

This walk is again at White's Point, off Paseo Del Mar, San Pedro. Park at top and walk in to save parking fee. Geoffrey Leister of California State University, Long Beach, will again lead. We expect different vegetation stages from our January trip. Minus 1.4 tide at 2:42 p.m.

May 29, 30 and 31 (Memorial Day week-end)
Soda Springs and Zzyzx

The Desert Studies Consortium again offers us their facilities at Zzyzx, including rooms, beds, mattresses, etc. and access to a stove. Take I-15 through Barstow towards Baker. Six miles before Baker is the Zzyzx turn-off, then about four miles of graded dirt road to the buildings. You may arrive until 10 p.m. Friday night when the generator is turned off. Assemble at 9 a.m., Saturday, with Alan Romspert as leader.

June 12 and 13, 1982, Saturday and Sunday
Greenhorn Mountains, Southern Sierras

Meet at 9:30 a.m. at the parking lot of Highland Knolls Public Golf course in Oildale, just north of Bakersfield. We will camp Saturday night in these beautiful mountains.

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CROSSOSOMA is published bimonthly (February, April, June, August, October and December) by Southern California Botanists, a non-profit association. Dues are on a calendar year basis. Regular $6.00. Students and Retirees $4.00. Groups $10.00.

We thank all those who promptly remitted their 1982 dues. All others, please send your checks. This Journal can only be sent to members whose dues are current.

COMING 1982 EVENTS (DETAILS WITHIN)

April 2-11	SCB Baja California trip.
April 3	SCB Plant Sale, Claremont, 8:00 a.m.
April 17-18	SCB Topock Gorge Canoe trip.
Aptil 23-25	SCB Catalina trip.
April 30-May 1	S.C. Acad. of Science Annual Mtg., Dominguez Hills.
May 8-9	SCB La Jolla Canyon trip.
May 14-19	Islands of Baja California.
May 15-16	San Joaquin Valley Vernal Pools trip.
May 21-23	Am. Cetacean Soc. trip.
May 23	SCB Algal Tide Pool Walk, 1:30 p.m.
May 29-31	Soda Springs and Zzyzx trip.
June 12-13	SCB Greenhorn Mountains trip.

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Rancho Santa Ana Botanic Garden
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Claremont, CA 91711

CROSSOSOMA

SOUTHERN CALIFORNIA BOTANISTS
Rancho Santa Ana Botanic Garden, Claremont CA 91711

Crossosoma Vol. 8, No. 3 June, 1982
Editors: W. Wright
A. Romspert

A COMPARISON OF THE PHOTOSYNTHETIC ABILITIES OF TWO INTERTIDAL SEAWEEDS

by

Brian Oates

The distinct vertical dispersion patterns found on many shorelines are shaped by both biotic and abiotic factors. The zonation patterns exhibited by intertidal species are ideal for ecological studies since upper and lower limits are rarely separated by more than a few meters. Generally, upper limits are regulated by physical factors such as insolation, desiccation, temperature, and rainfall, whereas lower limits are governed by biotic agents such as competitors and predators. These factors are of great interest to ecologists and, especially in the case of biotic factors (i.e., Connell 1961, Paine 1966), have played a part in the development of ecological theory.

Seaweeds are often the most conspicuous members of intertidal habitats. Dominant, overstory forming, seaweeds may strongly influence other organisms inhabiting a zone by buffering environmental extremes (i.e., light, temperature, and moisture) in the understory habitat at low tide. Seaweeds may also influence associated organisms by mechanically removing invertebrate and algal juveniles through whiplash, or by serving as a barrier to larval settlement (see Oates 1981, for review). Consequently, factors influencing the abundance and distribution of dominant seaweeds will affect the structure of associated communities.

In Southern California, the fucoid algae *Hesperophycus harveyanus* and *Pelvetia fastigiata* f. *gracilis* are common components of upper intertidal communities on rocky shores. A distinct boundary is typically formed between the lower limit of *H. harveyanus* and the upper limit of *P. fastigiata* f. *gracilis* on shores where both species occur, such as the leeward coast of Santa Catalina Island. The

contiguous distributional pattern, coupled with relatively little overlap of the two species in their vertical distribution, suggests a competitive interaction (Daubenmire 1966).

The present study was initiated to examine factors influencing the distinct boundary between these two seaweeds. The lower limit of *H. harveyanus* was examined using removal and transplant experiments. The data, however, has not conclusively identified the restricting agents, and consequently, this aspect of the study will not be discussed here. Factors affecting the upper limits of the two fucoids were examined by assessing the photosynthetic responses of the two fucoids under various conditions of submersion, emersion, and irradiance. Responses under submersed conditions were measured

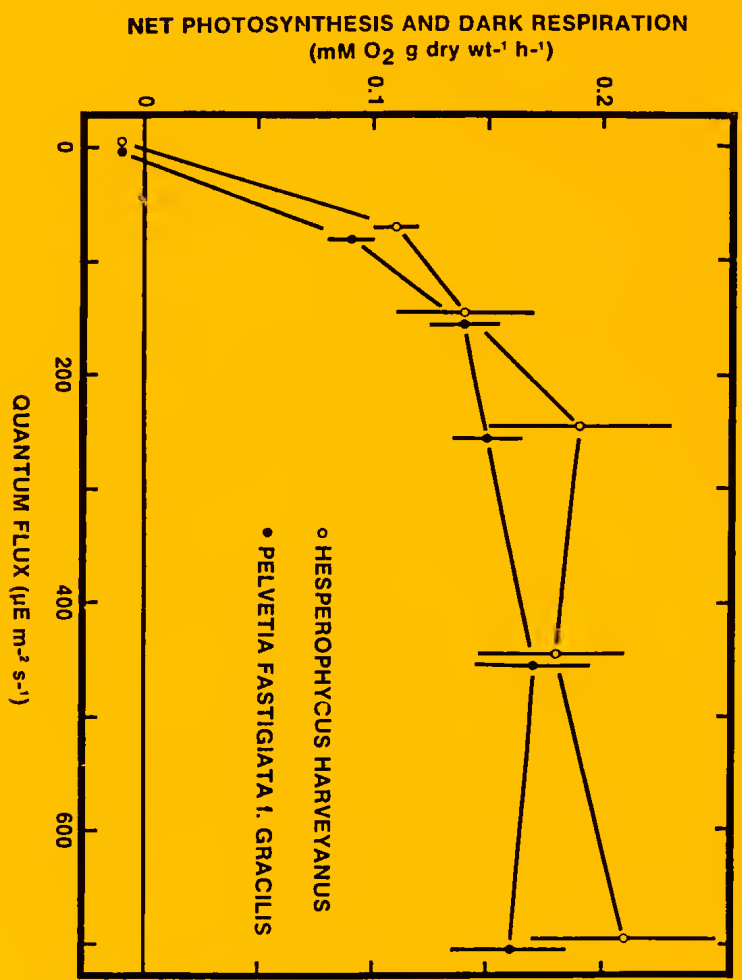

Figure 1. Submersed net photosynthesis (mean ± S.D.) as a function of irradiance and mean dark respiration values of *Hesperophycus harveyanus* and *Pelvetia fastigiata* f. *gracilis* at 18 C.

using the classical light bottle - dark bottle closed container technique, whereas emersed photosynthetic responses were assessed using an Infrared Gas Analyser (see Oates 1981).

Submersed photosynthetic studies failed to demonstrate any differences between *H. harveyanus* and *P. fastigiata* f. *gracilis* (Fig. 1). Both species exhibited low dark respiration rates, became photosynthetically saturated before 250 $\mu E\ m^{-2}\ s^{-1}$, exhibited similar photosynthetic maxima, and were not photoinhibited. These findings failed to support the hypothesis that faster growth rates observed for *P. fastigiata* f. *gracilis* resulted from greater photosynthetic abilities. Rather, it appears that the faster growth rates of *P. fastigiata* f. *gracilis* result from longer periods of submersion and extended access to nutrients.

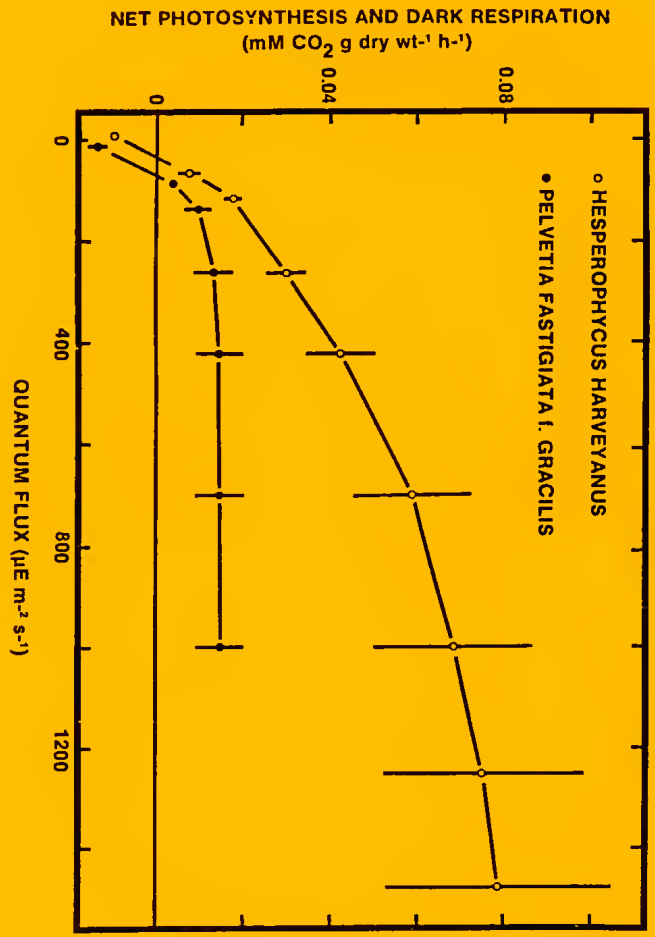

Figure 2. Emersed net photosynthesis (mean ± S.D.) as a function of irradiance and mean dark respiration values of *Hesperophycus harveyanus* and *Pelvetia fastigiata* f. *gracilis* at 18 C.

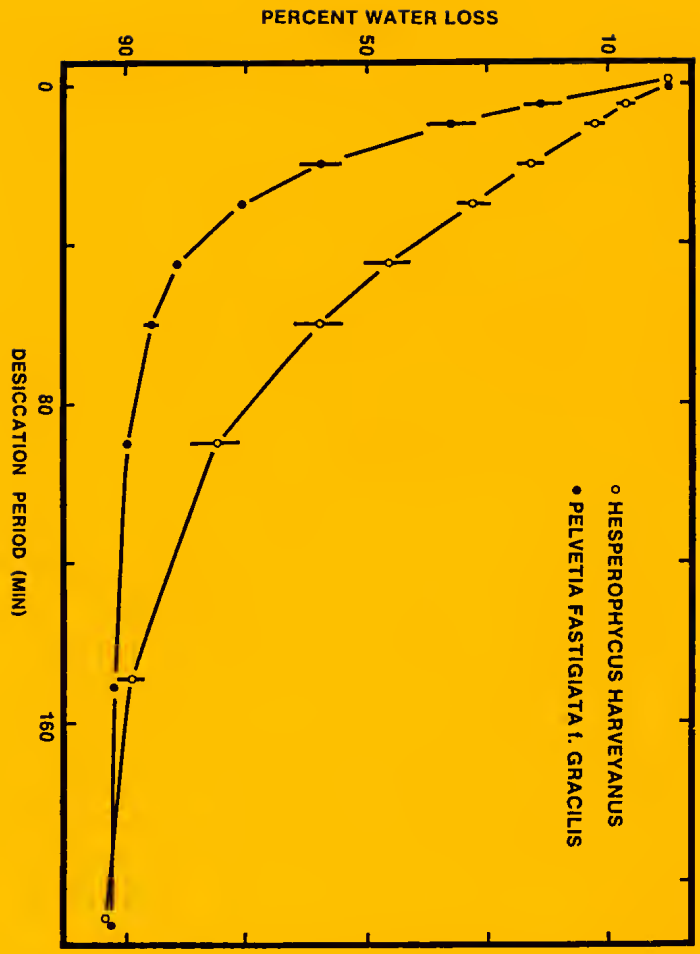

Figure 3. Relative rates of water loss in *Hesperophycus harveyanus* and *Pelvetia fastigiata* f. *gracilis* at 18 C.

Contrary to the findings under submersed conditions, emersed photosynthetic results showed differences in photosynthetic abilities of the two seaweeds in air (Fig. 2). *Hesperophycus harveyanus* appeared better adapted for photosynthesis out of water. This plant demonstrated low dark respiration rates, became saturated by approx. 700 $\mu E\ m^{-2}\ s^{-1}$, and showed no sign of photoinhibition. On the contrary, *P. fastigiata* f. *gracilis* exhibited low respiration rates, saturated by 125 $\mu E\ m^{-2}\ s^{-1}$, and did not become photoinhibited. Also, as can be seen in Figure 2, the maximal photosynthetic rate of *H. harveyanus* in air greatly exceeded that of *P. fastigiata* f. *gracilis*. Due to long periods in air *H. harveyanus* may depend heavily on this fraction of the overall photosynthetic budget.

Unfortunately, the mechanisms which afford *H. harveyanus* this ability remain unknown.

To further compare the photosynthetic abilities of the two seaweeds in air their rates of water loss and abilities to photosynthesize under various degrees of desiccation were measured (Fig. 3 and 4). Measurements of desiccation rates clearly demonstrated that *H. harveyanus* has a much greater ability to retain water. The more robust thallus and concomitant reduced surface area to volume ratio of *H. harveyanus* may restrict water loss from this alga. After normalizing the photosynthetic data (Fig. 4), it becomes clear that the two species respond similarly to water loss. Although they exhibit parallel photosynthetic responses to desiccation *H. harveyanus* shows

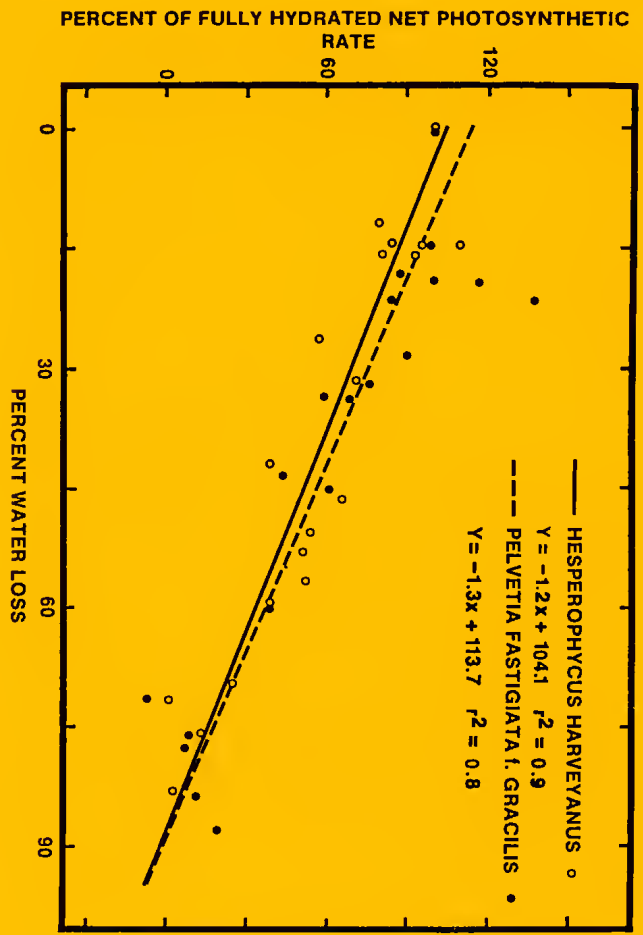

Figure 4. Emersed net photosynthesis (based on biomass) of *Hesperophycus harveyanus* and *Pelvetia fastigiata* f. *gracilis* as a function of water loss at 18 C.

a greater ability to retain moisture, and thereby remain physiologically active for longer periods at low tide.

This study provided the first opportunity to compare photosynthetic responses of intertidal seaweeds to varying light conditions, under submersed and emersed conditions. The greater photosynthetic ability of *H. harveyanus* in air is in agreement with other studies which have shown a relationship between tidal position inhabited and emersed photosynthesis (see Kremer 1981). The increase in irradiance required to saturate *H. harveyanus* under emersed conditions may result from a protective mechanism employed at low tide to offset high light levels (Oates 1981). Further research is required to determine the mechanism employed, and whether it is found in other high intertidal seaweeds.

In summary, it appears that there are distinct photosynthetic differences between *H. harveyanus* and *P. fastigiata* f. *gracilis*, and that these differences are habitat related. However, before the importance of emersed photosynthesis can be understood, for *H. harveyanus* and other intertidal seaweeds, many questions must be addressed. For example: Does emersed photosynthesis contribute significantly to the photosynthetic budget? Are the photosynthates accumulated while in air the same as those produced in water? Does the emersed photosynthetic consumption of nutrients have an adverse affect on submersed photosynthesis?

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FIELD TRIPS AND EVENTS

June 12 and 13, 1982, Saturday and Sunday
Greenhorn Mountains, Southern Sierras

Meet at 9:30 a.m. at the parking lot of Highland Knolls Public Golf Course in Oildale, just north of Bakersfield. We will camp Saturday night in these beautiful mountains.

July 2-5, 1982 (Fouth of July Weekend)
Panamint Mountains

The SCB field trip of July 2-5, 1982, will investigate two areas in the Panamint Mountains. The first area will be Telescope Peak at an elevation of 11,049 ft., which gives a spectacular view into both Death Valley and Panamint Valley. It is reached by a seven-mile, well-marked trail. Bristle cone pines, three species of gooseberries, and several plant endemics will highlight Saturday's activities. On Sunday we will travel to Aguereberry Point (at 6,433 ft.), where an arduous hike over to Tetracoccus Ridge is well rewarded with endemics. *Tetracoccus ilicifolius, Arctomecon merriamii, Astragalus panamintensis, Penstemon calcareous, Enceliopsis nudicaulis, Gilia ripleyi, Cercocarpus intricatus* and *Buddleja utahensis* are a few of the more interesting plants which occur on Tetracoccus Ridge.

Interested parties should meet Friday night or early Saturday morning at Thorndike Campgrounds in Wildrose Canyon. Bring water and firewood or charcoal. There is no drinking water, and the collecting of firewood is prohibited in Death Valley National Monument. To reach Thorndike Campgrounds, go north on Highway 395 to the Trona Road cut-off just north of Johannesburg (AAA San Bernardino County map), proceed to Highway 178 and turn right towards Trona. Stay on Highway 178 through Trona into Panamint Valley, where the road is called Trona-Wildrose Road, until you reach the Wildrose Canyon turnoff (AAA Death Valley map). There is about three miles of graded dirt road in reach Thorndike Campground which should be easily traversed in a normal passenger vehicle. For further information call Alan Romspert (714) 773-2428 or Walt Wright (714) 529-4134.

July 17 and 18, 1982, Saturday and Sunday
Figueroa Mt. - Refugio Falls (Santa Barbara County).

Call Walt Wright (714) 529-4134, for details.

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COMING 1982 EVENTS (DETAILS WITHIN)

June 12-13 Greenhorn Mountains

July 2-5 Panamint Mountains

July 17-18 Figueroa Mt. - Refugio Falls

CROSSOSOMA

SOUTHERN CALIFORNIA BOTANISTS
Rancho Santa Ana Botanic Garden, Claremont CA 91711

Crossosoma Vol. 8, No. 4 August, 1982
Editors: C. Clark
R. Thorne

SOME PHYTOGEOGRAPHICAL AND PHYLOGENETIC STATISTICS

by

Robert R. Thorne
Rancho Santa Ana Botanic Garden
Claremont, CA 91711

The recent book "Phytochemistry and Angiosperm Phylogeny" (Young and Seigler 1981) includes with my summary statement a synopsis of my classification of the Angiospermae with figures on the number of taxa involved at each categorical level. Because the book has had little circulation, *Crossosoma* readers might be interested in a few of those figures, as somewhat modified by new data. My best estimate of the generally accepted taxa for the two flowering-plant subclasses, Dicotyledoneae and Monocotyledoneae, is 225,000 described species organized into 12,250 genera, 444 subfamilies, 347 families, 66 suborders, 52 orders, and 28 superorders. Because some taxonomists treat many of my subfamilies as full families, perhaps the most realistic unit to use is the subfamily. Thus, the combined total of the subfamilies and undivided families that I accept is 677.

Lately I have been much interested in recording the number of families and additional subfamilies found to be indigenous, or even endemic, in various parts of the world. Table 1 is the result of this effort, involving the study of many floras and other botanical reference works as well as many field and herbarium surveys. The families and subfamilies are based on my latest published synopsis (Thorne 1981), now somewhat modified. Though other taxonomists may not agree with my interpretation of family and subfamily limits, at least the table is consistent throughout. Some explanation may be desirable. The continents and other areas are arranged by decreasing number of indigenous families. The listed continents include immediately adjacent continental islands, as Greenland and Canadian Arctic Archipelago with North America. Europe is divided arbitrarily from Asia by the Ural Mts., Caspian Sea, Caucasus, and

Table I

Angiosperm Families and Subfamilies Indigenous to Large Areas

	Families		Additional Subfamilies		Total Subfamilies and Undivided Families	
	Indigenous	*Endemic*	*Indigenous*	*Endemic*	*Indigenous*	*Endemic*
World	347	-	330	-	677	-
Asia	248	23	204	16	452	39
South America	230	19	177	26	407	45
North America (incl. Mexico)	224	9	164	11	388	20
Middle America	220	4	166	9	386	13
Malesia	213	5	142	1	355	6
Africa S of Sahara	207	18	162	23	369	41
Australasia	198	15	147	20	345	35
North America N of Mexico	185	5	125	2	310	7
Madagascar and other Indian Ocean islands	177	6	119	11	296	17
Pacific Basin	168	1	102	0	270	1
Europe and North Africa	125	0	83	1	208	1
Antarctica	2	0	0	0	2	0

Black Sea, with Europe including Mediterranean Africa, the Canary and Madeira Islands, and Iceland. Africa here encompasses the mainland south of the Sahara; whereas, Madacascar, Socotra, the Seychelles, and other Indian Ocean islands are treated as a separate unit. Australasia here consists of Australia, Tasmania, New Zealand, and New Caledonia with their satellite islands. Malesia includes Malaysia, Indonesia, the Philippines, and Melanesia north of Australasia east to the Andesite Line, thus encompassing New Guinea and Figi and intervening island groups. There is some overlap with Asia for I have included with it Japan, the Ryukyus, Taiwan, Hainan, and the continental islands west of the Moluccas and south of the Philippines. I have "resolved" the overlapping floras of the Americas by arbitrarily dividing them into North America (with and without Mexico), South America (south of Panama but including Trinidad), and Middle America (Mexico, Central America, and the West Indies). Our Mexican friends refer to us as norteamericanos, so presumably they do not consider themselves part of North America though obviously they are, geographically and botanically. At any rate, Table I treats them both ways so that no feelings should be bruised. Middle America is much enriched by the heavy intrusion of North and South American floristic units as well as by its own endemic taxa, which often in their turn invade the two adjacent continents. The Pacific Basin includes all the oceanic islands of the Pacific east and north of Asia, Malesia and Australasia, including the Juan Fernandez, Desventuradas, Galapagos, Cocos, Revillagigedo, and Guadalupe islands of the eastern Pacific.

Some interpretation of the results in the table may also be desirable. The floristically richest continents are Asia and South America. The latter large "island" continent has the most endemic taxa probably because of its long isolation from the rest of the world. Endemic taxa are those restricted to the region or essentially so, with occasionally some minor representation in adjacent areas. South American endemic families or subfamilies reach north into Middle America and a couple even into subtropical Florida. Some Asian endemics range into Malesia or the western fringes of the Pacific Basin. Malesia is much enriched by additions from both Asia and Australasia. North America is relatively poor in endemic families and subfamilies because of its long involvement with Asia and Europe and more recent tectonic linkup with South America through the Middle American isthmus. Six strictly American families and 16 subfamilies are so evenly or widely distributed in the Americas that I did not include them as endemics in Table I. Among them are the Cannaceae, Cyrillaceae, Krameriaceae, Martyniaceae, Sarraceniaceae, Eriogonoideae, Opuntiodeae, and Tillandsioideae, so well known to American botanists. Europe is floristically depauperate in higher categories because of its lack of tropical areas and heavy recent continental glaciation, combined with blocking east-west mountain ranges and seas. It is low in family-subfamily endemism because of long and broad ties to Asia and Africa, not to mention tectonic linkage in the past with North America. Only the monotypic subfamily Rosmarinoideae of the Lamiaceae is restricted to Europe and Mediterranean Africa. The dispecific angiosperm flora of Antarctica, the grass *Deschampsia antarctica* (Hook. f.) Desv. and the pink *Colobanthus quitensis* (Kunth) Bartl., recently received at RSA-POM, may result from the somewhat rigorous climatic conditions offered by that glacier-ridden continent. Southern California botanists may wish identification of the seven North American (north of Mexico) endemics: Crossosomataceae (of course), Garryaceae, Leitneriaceae, Limnanthaceae, Simmondsiaceae, Eschsholzioideae, and Platystemonoideae, all but *Leitneria floridana* Chapm. represented in California. All but *Leitneria* and Limnanthaceae also reach Mexico. The largely Middle American endemics include several also represented in California or other border states, as Fouquieriaceae, Lennoaceae, Agavoideae, and Achatocarpoideae.

Southern California botanists may be interested too in the number of indigenous angiosperm families in California and adjacent or other American areas: 129 in Alta California, 128 in Baja California, and 120 in Arizona but 153 in Texas, 161 in Florida, 144 in the Gray's Manual area (NE U.S.A.), and 165 in the Small's Manual area (SE U.S.A.). Much surpassing the 185 families and 125 additional subfamilies of the U.S.A. are Mexico's 210 families and 156 addi-

tional subfamilies. Some foreign floras also tabulated in the study are Malaya with 178, Ceylon (Sri Lanka) with 170, Jamaica with 153, Chile with 139, and Galapagos Islands with 69 indigenous families.

For those taxonomists, especially in the Old World, who regard me as a "lumper" for defining my taxa too broadly, I have examined my taxa and found that I have recognized 230 monogeneric and 71 digeneric families and subfamilies. Of the 105 monogeneric families 35 are monospecific, 21 dispecific, and 49 with three or more species. The 125 monogeneric subfamilies contain 48 monospecific, 20 dispecific, and 57 with three or more species. There are 24 digeneric families and 47 digeneric subfamilies. These evolutionary twig-ends must be recognized as families or subfamilies because of the large phyletic gaps between them and their closest surviving relatives. The number of species in a taxon should have no bearing on its ranking. Presumably the ultimate goal of the dedicated "splitters" will be the recognition of each of the 12,250 accepted genera as distinct families. Taxonomic inflation, however, should be avoided unless required by compelling evidence indicating adequate phyletic gaps or evolutionary convergence from unrelated ancestors.

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WHAT IS A "TYPE SPECIMEN"?

by

Curtis Clark

Carl Linnaeus, the Swedish botanist of the eighteenth century who developed the binomial system of nomenclature we use today, and other botanists of his time, believed that the best way to know a plant species was to know its "archetype," the set of features which was both necessary and sufficient to define the species. They believed that variation within a species was an accident of development. Thus, when Linnaeus named a plant species, he described its archetype. He chose specimens for his herbarium that he felt best matched the archetype; if they differed in a few minor points, that was only to be expected. In the two hundred years since, biologists have learned of evolution, genetics, and

molecular biology, and we now dismiss the idea of an idealized "archetype" of a species. We realize that the variation among plants in a species is an integral part of their biology, reflecting adaptations to varying environments, expression of inherited genetic differences, and chance mutations. These advances in knowledge have played havoc with plant taxonomy, however. In the time of Linnaeus, the name of a plant referred to its archetype; whether an individual plant belonged to a certain species depended on its similarity to the description of the archetype. This avoided arguments over the application of a name. When the idea of archetypes was discarded, it was still necessary to have something to "hang a name on."

The obvious choice was the plants themselves. But plants vary. So botanists came up with the idea of the "nomenclatural type," a *single plant specimen* to which the name of a species is forever linked. When Adelbert von Chamisso described the California Poppy, *Eschscholzia californica*, in 1820, he designated a single specimen, collected at San Francisco, as the type specimen. George Bentham decided in 1835 that the poppies of the interior valleys constituted a different species from those along the coast. The name *Eschscholzia californica* was already attached to a specimen of coastal poppy, so Bentham gave the other, inland poppy a new name, *Eschscholzia crocea*, and selected a type specimen for it. (Most taxonomists today believe that these should be included in a single species. It must be called *E. californica*, and not *E. crocea*, because of the law of priority--that the earliest name be chosen.)

Type specimens are vitally important to taxonomists, for they are our only way of tying names to plants. One of the requirements for publishing the name of a new species is that a type specimen be designated. Type specimens are usually held in herbaria, where they arc given much more care than the average specimen. Many herbaria maintain type collections in separate cases, and ask that visitors refrain from examining them unless they have a specific need to do so. Herbaria often lend type specimens as well as other specimens for study by taxonomists at other herbaria; the borrowing herbaria take more precautions with the borrowed types than they do with their own collections.

There are several specific terms that apply to type collections. A single specimen designated by the author of a new species as the type is called a *holotype*. Duplicates of that specimen (collected at the same place on the same date) are *isotypes*; these are often sent to other herbaria. If an author does not select a holotype from among the duplicate collections, they are all *syntypes*. If a holotype is lost or destroyed, another taxonomist can choose one of the isotypes to take its place; the isotype is then

called a *lectotype.* A lectotype can also be chosen from among syntypes. This is especially important when syntypes are judged to represent more than one species. If all the original type material is lost, a *neotype* may be selected. Taxonomists generally choose as lectotypes and neotypes those specimens that best fit the original description of the species.

TREE BOOKS COMPARED

Perry, Bob. 1981. Trees and shrubs for dry California landscapes: plants for water conservation. San Dimas, Ca.: Land Design Publishing. iv, 184p. $28.50.

Lenz, Lee W. and John Dourley. 1981. California native trees and shrubs: for garden and environmental use in Southern California and adjacent areas. Claremont, Ca.: Rancho Santa Ana Botanic Garden. xiii, 232p. $29.50 (hardbound); $23.50 (pbk.)

Courtright, Gordon. 1979. Trees and shrubs for western gardens. Forest Grove, Or.: Timber Press. 239p. $42.50.

Recently Gordon Courtright's visual plant dictionary, *Trees and Shrubs for Western Gardens*, was joined by two new publications of interest to botanists and horticulturists in Southern California. Since all of these publications are currently offered by SCB Booksales, it is hoped that a comparison of them will prove useful.

Courtright's book contains 673 color photographs of 5-15 year old plants in garden settings. These photos give the reader an idea not only what the plant looks like, but how it can actually be used in garden landscaping. Some photographs are closeups of foliage in a one square foot area. This allows one to develop a list of desirable species for a home garden by giving a clear idea of how the plants will look when mature. Plants included are suitable for use in Oregon and Washington as well as California, and both natives and non-natives are represented. The use of the phrase "trees and shrubs" in the title is somewhat misleading, since nonwoody ornamental species such as grasses, sedges, ferns, etc. are included. Plants are grouped by size categories ranging from low growing plants to trees, and there is also a section on vines. Within this organizational framework there is an in-depth discussion of species, with numerous horticultural varieties designated for such groups as azaleas, camellias, fuschias, etc.

Information provided for each plant species includes a temperature guide, broad horticultural requirements for sun exposure, drainage, soil, etc. and a general discussion of the useful or desired features of the plant, including the time of the year the flowers,

fruit and/or foliage is most dramatic. Plants can readily be found through the alphabetized indices of scientific and common names. Courtright has provided lists with species grouped by flower color, fragrancy, and whether they can grow in different problem locations such as seashore, damp, or dry areas. Lists of plants resistant to animal predation, e.g., deer, and diseases, such as oak root fungus, are also given.

The book contains many of the currently used ornamental species, including those species planted before water conservation and the popular demand for native species. Thus the book serves as an excellent reference for identification of plants present in established neighborhoods, in parks, or along older streets and freeways.

Bob Perry's publication, *Trees and Shrubs for Dry California Landscapes*, recently reviewed in *Crossosoma*, Vol. 7, no. 6, by Barbara Joe Hoshizaki, is invaluable for homeowners and landscape architects who must consider water conservation when planning gardens in California. It covers native and non-native plants suitable for coastal areas, inland foothill areas, and the low desert. Plants suitable for the high desert are not included. There are more than 500 color photographs, with many plants shown in full and also in close-up shots of their foliage, fruits, and flowers. This duplication of photographs results in some species not being pictured. As in the Courtright book, some of the photographs show how the plant would look in a home garden or how it could be used for landscaping. Perry also includes some non-woody species, and groups his plants by genus. For each species a summary is given of the local environment (coast to inland mountains) for which it would be suitable. Handling and care information is given for the plants. General descriptions, as well as suborganization by size categories ranging from ground covers to large trees, is given only in a table.

An extremely valuable contribution of the book is the list of plants grouped by fire fuel potential. Planting with this in mind could significantly reduce future fire hazards in fire prone areas. Another section discusses plants in relation to their root systems and potential invasiveness. The time has passed when these factors can be disregarded in establishing new plantings, as not all plants stay in areas intended for them. Evergreen and drought resistant deciduous species are listed, giving the reader an idea of how the plants will respond to our dry seasons.

Lenz and Dourley, in their book, *California Native Trees and Shrubs*, have further restricted their coverage to those native species which can be used in Southern California, and unlike the other two authors, their coverage is only of woody species. These native species include plants from southern Nevada, western Arizona, and

northern Baja California as well as from local Southern California areas. The authors introduce the reader to the native vegetation by covering the various climates, soil types, plant communities and geographic regions of Southern California, as well as northern Baja. Communities are described with graphs showing average monthly temperatures and precipitation along with dominant plant species.

Organization of plant species is alphabetical by genus, similar to Perry's approach, with an index indicating the areas where those plants are most suitable. Only those species the authors have had experience with in cultivation are covered; i.e., not all species found in the area are included. This proves to be the strong area of this publication, since the first-hand information learned from working with the plants allows the authors to give the reader more help concerning the actual cultivation of plants discussed.

Although the publication has excellent color photographs, many of the species discussed are not pictured. However, some species are shown by good quality black and white photographs or by detailed line drawings. The lack of pictures is more than made up for by the excellent description of each species, and an easy to understand glossary at the back of the book. Although the general public would undoubtedly prefer pictures to detailed text, this would very likely have priced the publication beyond the reach of most of its intended audience.

Of special interest to the gardener with little reading time is the section wherein the authors summarize the potential for survival without care. These are species which were cultivated and have persisted at the now abandoned site of the original Rancho Santa Ana Botanic Garden. These plants received no supplemental care for approximately 25 years. Although many of these species do not naturally occur in the location of the garden, they continue to survive.

While ownership of one of the books would not necessitate having one or both of the others, neither would it preclude it. Their interrelationship can be shown by an example of a person who decides that a juniper would be nice to include in his landscape. Lenz and Dourley indicate their success with three native species and show where these species could be expected to grow. Perry, from a landscape architect's point of view, tells the reader that the native junipers don't do well around domestic dwellings and are better used in the more natural environmental setting. Courtright gives the reader a list of 28 species or varieties which might be used, depending on the location in a landscape area.

Eric and Linda Hansen

FIELD TRIPS AND EVENTS

August 14, 1982 (Saturday)
UC James Reserve, San Jacinto Mountains

This University of California ecological reserve at 5400 feet elevation contains a diverse mixed conifer forest with lush streamside growth. Meet Saturday morning at 8:30 a.m. at the Lake Fulmer parking lot on Highway 243, 15 miles south of Banning, 10 miles north of Ilyllwild. Camping Friday night is available by reservation. Campers contact Ken Berg at P.O. Box 221, Banning, CA 92220, phone 714-659-3811, for gate lock combination.

September 4-6, 1982 (Labor Day Weekend)
White Mountain Trip

Meet Saturday morning at 9:00 o'clock at Inyo County Recreation and Park area at the north end of Big Pine - intersection of US 395 and St. Hwy. 168. Overnight camping is permissible here; water and toilet facilities are also available here. Saturday night - camp at Grandview Campground which is approximately eight miles from the intersection of St. Hwy. 168 and White Mountain Road on White Mountain Road. There is no water available; there are pit toilets. Days are warm, but nights can be quite cold.

Books: *A Flora of the White Mountains, California and Nevada* by Lloyd Mitchell.
A Flora of California by Munz.

ANNUAL POTLUCK DINNER AND PROGRAM

Olney Dining Hall, Pomona College, Claremont
Saturday, October 16, 1982

Dinner will start at 6:00. After dinner we will have a program of slides, title and speaker to be announced in the October newsletter. As usual, beverage and bread will be provided by SCB. It is suggested that if your last name begins with the following letters, you bring specified dish for self and four additional people: A-I, dessert; J-P, side dish (vegetable, salad, etc.), Q-Z, main dish. Be sure to bring your own table service.

To reach the dining hall, exit from I-10 at Indian Hill. Go north to Bonita Avenue (actually 3rd St.--Bonita is between 2nd and 4th). Turn right and go four blocks past Wig Hall and Harwood Court on the right. Park in front of Harwood or turn right and park alongside Harwood. Olney Dining Hall is behind (south of Harwood).

SCB books will be available. Please come! This is always a most enjoyable evening.

Highlights of Memorial Day field trip to Zzyzx

The field trip proved fantastic, due to both the weather and the plants cooperating. Some fungi were collected, *Tulostoma sp* (the desert puff ball) and *Podaxis pistillaris* (desert shaggy mane) near the living quarters, in association with *Tamarix pentandra* and *Ammbrosia dumosa.*

During Saturday's field trip we examined the vegetation at Zzyzx especially round the ponds where *Anemopsis californica* (the lizard tail), *Juneus cooperi* and *Scirpus acutus* (Tule) grew in abundance. Along the road to the highway, a stop was made to examine some Indian petroglyphs and some signatures on the rocks dated 1859. Then we proceeded to Afton canyon which is a veritable oasis in the desert. The walls of the canyon are multicolored and the Mojave River was flowing through the canyon. A fine specimen of *Chilopsis linearis* (desert willow)(Bignoniaceae) was in full bloom by the road.

Sunday's foray followed Kelbaker Road south, where the desert flowers were in bloom at the higher elevations. *Cassia armata* made a spectacular show and *Yucca brevifolia* var. *jaegeriana* was laden with fruit.

A rare find was *Pholisma arenarium,* a root parasite (Lenoaccae). Three inflorescences were visible above the ground and these were covered by small ants. There were many small annuals, *Lupinus concinnus, Malacothrix glabrata* (desert dandelion), *Salvia columbariae* (chia), *S. dorrii* (Mojave sage), *Baileya pleniradiata* (desert marigold) and many species of *Eriogonum* (buckwheat). Also present in bloom was *Machaeranthera tortifolia* (desert aster).

After a brief visit to the unique railway station at Kelso we headed northeast to Cima where *Opuntia basilaris* was blooming, then north to Valley Well. Here we examined the underground housing left from mining days.

Finally we headed for Keany Pass in the Clark Mountain Range, and were rewarded by finding *Agave utahensis* var. *nevadensis, Verbena gooddingii, Buddleja utahensis, Mortonia utahensis, Ferrocactus acanthodes* var. *lecontei, Penstemon palmeri,* all in bloom, and *Ephedra nevadensis.*

Many thanks go to A. Romspert for sharing his knowledge and for locating these unique and interesting plants. Indeed his expertise was greatly appreciated.

CROSSOSOMA is published bimonthly (February, April, June, August, October and December) by Southern California Botanists, a non-profit association. Dues are on a calendar year basis. Regular $6.00. Students and Retirees $4.00. Groups $10.00.

We thank all those who promptly remitted their 1982 dues. All others, please send your checks. This Journal can only be sent to members whose dues are current.

COMING 1982 EVENTS (DETAILS WITHIN)

August 14	UC James Reserve, San Jacinto Mountains
September 4-6	White Mountain Trip
October 16	Pot Luck Dinner and Program

SOUTHERN CALIFORNIA BOTANISTS
Rancho Santa Ana Botanic Garden
1500 North College Avenue
Claremont, CA 91711

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Rancho Santa Ana Botanic Garden, Claremont CA 91711

Crossosoma Vol. 8, No. 5
Editor: R. John Little October, 1982

PROGRAM ISSUE

Current Issues in Biogeography

Saturday, October 23, 1982

California State University, Fullerton

Welcome to the Eighth Annual Symposium of the Southern California Botanists, cosponsored for the second year by the Department of Biological Science of California State University, Fullerton.

In the past 10-15 years there has been a revolution in Comparative Biology concerning methodologies of studying order in nature. With recent advances in plate tectonics, the study of the geography of organisms has entered this arena of exciting controversy in which there are two general schools of thought. One, which might be called classical biogeography, rests heavily on long distance, independent dispersal as an explanation of biotic patterns of distribution. The other, which has come to be labeled vicariance biogeography, relies on phylogenetic relationships among sister taxa and the explanation of these patterns based on an underlying tectonic history of the region(s) in question. While the classical school considers centers of origin and dispersal, the vicariance school deals with patterns of endemism and geneology. Although the scope of these biogeographic issues are much too broad for a one day symposium, we have attempted to select speakers who will touch on some of these issues.

The Symposium will convene in the California State University Fullerton, University Center, Multi-purpose Rooms A and B, on Saturday, October 23, 1982, from 8 a.m. to 5:30 p.m. General admission is $10.00. The admission for members of the Southern California Botanists and students is $5.00.

The following is a list of the times, titles and abstracts submitted by the speakers. Following each talk there will be a brief period for questions.

8:00-9:00 Registration

9:00-9:05 Welcome and Introductions, Jewel Plummer Cobb, President, California State University, Fullerton

9:05-9:15 Introductory Remarks, Michael Horn, California State University, Fullerton

9:15-10:00 "Some Principles of Biogeography"
Robert F. Thorne, Rancho Santa Ana Botanic Garden

Some vicariantists are convinced that they have recently discovered the definitive approach to biogeography that will place that maligned "art" upon a firm "scientific" basis. Their overly simplistic approach results from apparent ignorance of classical biogeographic, especially phytogeographic, literature. I have attempted, therefore, to assemble a series of biogeographic principles gleaned from the publications of many competent plant and animal geographers, who have been assiduously tilling the vineyards of biogeography long before the vicariantists discovered Willi Hennig and Leon Croizat. These principles are listed with some cogent examples of their application by geographers.

Perhaps the most important operating principle of biogeography is that biogeographic inferences and conclusions should be based upon the study of all biotic groups, both plant and animal, and especially upon those groups recently revised by competent specialists. Other selected principles stress the importance of field experience and knowledge of the fossil record, past climatology, plate tectonics, vagility of diverse biotic groups, endemism, and oceanic islands and their biogeographic significance.

10:00-10:15 Break

10:15-11:00 "The Geography of Intimate Associations"
Geerat J. Vermeij, University of Maryland

It often happens that one species of organism lives in close association with another in a relationship which is beneficial to one or both parties. How do such associations arise? I believe that predation is an important agent of natural selection which is responsible for the evolution of intimate associations. By living in or near a predation-resistant host, a predation-vulnerable guest gains protection from many would-be hunters.

The selection that is imposed by predators is not uniform geographically or ecologically. It increases from temperate latitudes to the tropics, from fresh to salt water, from high to low latitudes, from the upper to the lower rocky shore, and within the tropics from the Atlantic to the Pacific and Indian Oceans. The incidence of intimate associations generally follows similar patterns.

In most intimate associations, there is evidence that the guest has adapted to conditions in the host, but whether the host has counteradapted to the presence of the guest is in most instances less well understood and less likely. The conditions which permit coevolution (reciprocal adaptation) between guest and host are stringent, and in nature are often not satisfied. Wide dispersal of larvae or eggs promotes genetic mixing between population and therefore often prevents the spread of genetic tendencies toward reciprocity. Coevolutionary relationships are more common on land than in the sea perhaps because land plants and animals are as a rule less well dispersed than marine species.

11:00-11:45 "Analysis of Size Structure in Island Communities"
Ted J. Case, University of California, San Diego

The presence of regular arrangement of body sizes in a guild of similar species occupying a common habitat is often taken as evidence that these species are avoiding interspecific competition by eating different sized prey. Severe difficulties arise, however, in statistically determining what constitutes a "regular" body size configuration. Some Monte Carlo techniques used in the past suffer from type 2 statistical error, i.e. there is a danger of accepting the null hypothesis when in fact it is wrong. In spite of this inherent bias, it is possible to show that for three systems (Galapagos finches, Cnemidophorus lizards of the southwest U.S., and West Indies birds) the arrangement of body sizes within guilds is decidedly non-random and is consistent with an explanation based on classical competition theory.

12:00-1:30 Lunch Break. Open House - Arboretum & Greenhouses

1:30-2:15 "Testing Modes of Speciation Using Biogeography"
E.O. Wiley, University of Kansas

Vicariance biogeography is a methodology which attempts to discover the relationships between geographic regions by studying the distributions of organisms which inhabit the regions. Assumptions of dispersal are set aside in favor of searching for replicate patterns of distribution among taxa endemic to each area. Essentially, this consists of seeing if phylogenetic hypotheses for the groups match the distributions of taxa. When working with groups of species, this method may be used to test speciation modes because different modes of speciation result in different patterns of biogeography. For example, we might expect widespread geographic and phylogenetic congruence between groups of species if the mode of speciation is large-scale geographic subdivision. If, however, the mode of speciation is one involving peripheral isolates,

we might expect to see little congruence between groups because the chances for congruent speciation of peripheral isolates is relatively low. Speciation involving sympatric mechanisms, either ecological subdivision or speciation via hybridization should result in no congruence. Stasipatric speciation should also result in non-congruence. The major problems involve parapatric speciation, which may result in patterns similar to allopatric speciation, thus lowering the utility of the method. In the one case where we have sufficient data, all unique, noncongruent, patterns involve small geographic isolates while congruence involves large geographic areas. Assumptions needed to make such tests are (1) speciation patterns recent enough to preclude widespread dispersal after speciation, (2) no extinction or knowledge of the phylogenetic and biogeographic relationships of all relevant fossils. Obviously, not any group of species and areas will do.

2:15-3:00 "Biogeographical Theories from Systematic Information"
Chris J. Humphries, British Museum of Natural History

The main developments in cladistic biogeography have involved the following:

1) A welding of Croizat's "Panbiogeographic method" with "cladistics" to give "vicariance biogeography"--a method of analysis of biogeographical patterns independent of evolutionary assumptions such as "centres of origin" and "long distance dispersals."
2) The use and development of new methods, such as area cladograms and component analysis for extracting pattern information from seemingly incongruent data.
3) The ideas that biological patterns conceived through the methods of vicariance biogeography can test other sources of information about earth history, such as geological theories, by assuming that organisms and the earth evolved together.

A discussion of these developments will be presented with reference to examples from the southern biota. Two examples will be discussed. The first will interpret transantarctic patterns, particularly for Australia, New Zealand, Tasmania, New Caledonia, southern South America and Papua New Guinea in relation to continental drift sequences to give a general theory of area interrelationships for the southern hemisphere. The second will look at various plant and avian patterns to present a general theory of area interrelationships for within continental Australia and Papua New Guinea.

It is curious that despite a major refutation of Matthew-Wallace long-distance disperal theories by modern tectonic theories there is

a reluctance to accept a comparable shift in biological reasoning. The main conclusions of this paper will hopefully show that many biogeographical theories are not tools for further investigation but more frequently unique specialist opinions about "pet" groups.

3:00-3:15 Break

3:15-4:00 "Biogeographic History of South American Freshwater Stingrays"
Dan R. Brooks, University of British Columbia

Ecological associations among different species may be the result either of vicariance or of colonization. In the first case, species are associated with areas by means of common descent. In a sense, they have been inherited with the areas in which they now occur. Colonizers, on the other hand, differentiated in other areas prior to entering a particular community. Robust explanations of the evolutionary history of a given community must provide means of differentiating between association by descent and association by colonization. The form of such explanations parallels questions of coevolution and of host-switching in studies of host-parasite systems.

Phylogenetic analyses of each member of a community and its closest relatives (at least two) may be combined in a single consensus cladogram highlighting the pattern of historical continuity among different communities. From such a consensus tree both vicariant, or coevolving, and colonizing elements may be discerned. Production of the consensus tree involves converting each of the cladograms produced for individual taxa into a matrix of binary characters using additive binary coding. A consensus cladogram is then produced from the large binary matrix. Species which show up as homologues of areas are those which vicariated with the areas. Colonizers appear as homoplasious residents of areas.

A practical example of the use of this technique involves the parasites of neotropical freshwater stingrays and the various river systems in which they live. All the parasites examined utilize multiple hosts, including invertebrates and vertebrates, in their life cycles. Thus, the parasites are symbols for much larger ecological assemblages including many members of each river system. The evolution of those communities, as symbolized by some of their members, involves an early background of vicariance plus two major, relatively more recent, episodes of dispersal.

4:00-4:15 Summary, James D. Smith, California State University, Fullerton

4:30-5:30 Reception, University Center Patio. Hosted by the CSUF Department of Biological Science

A note about the Southern California Botanists:

Southern California Botanists was founded in 1927 and presently has over 300 members. Our membership includes not only professional botanists, colleges and universities, arboreta, herbaria and museums, but also many interested laypersons. Our activities include an active program of field trips throughout the year, an annual symposium, lecture series and a potluck dinner. Southern California Botanists book sales offer members hundreds of quality books at substantial discounts. Many books not held in regular stock may be special-ordered. Southern California Botanists supports conservation efforts of many worthwhile groups and organizations.

Crossosoma is the journal of the Southern California Botanists and contains articles of both scientific and general interest. Among the purposes of this journal is the promotion of contemporary issues of conservation, especially in relation to botanical resources. All members are encouraged to submit articles for publication in *Crossosoma*. We are eager to have quality articles on botany in Southern California, and articles, notes and notices of interest to our members. Please submit these to Editor, *Crossosoma*, 1500 N. College Ave., Claremont, CA 91711. Authors of botanical articles published receive ten extra copies of the issue.

CONSERVATION NOTE

The northernmost stand of Tecate cypress (*Cupressus guadalupensis forbesii*) is threatened by a firebreak two city blocks wide "to be crushed with ball and chain" by the County of Orange. Associated with the cypress are the rare heart-leaved pitcher sage (*Lepechinia cardiophylla*) and San Diego reed grass (*Calamagrostis densa*).

Tecate cypress

About half of the main stand of Tecates is on the property of Coal Canyon Partnership, which proposes to open a shooting range in the bottom of the canyon. The most ecologically sensitive area of Tecates, Claymine Canyon, is threatened by a proposed police firing range, which points into the heart of the canyon.

The Orange County Planning Commission granted the shooting range permit without protection for the Tecates and with a number

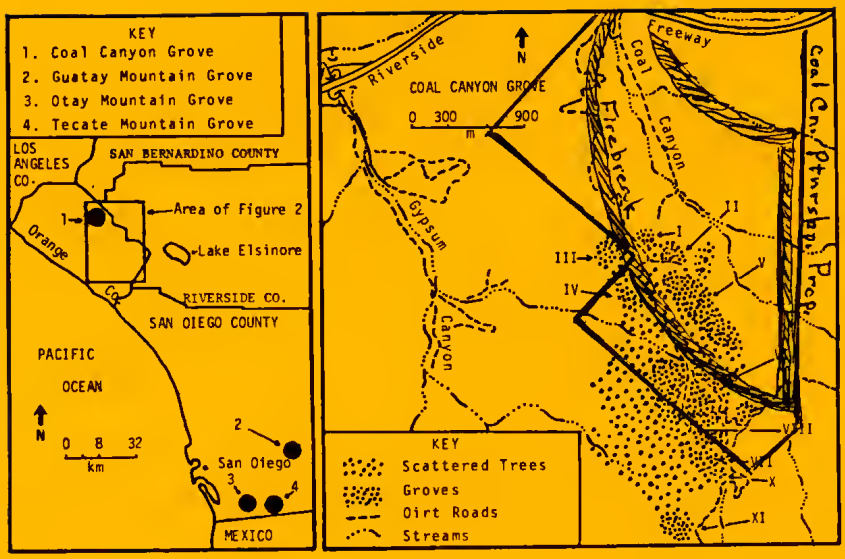

Fig. 1. Map comparing location of the Santa Ana Mountain main study area (Coal Canyon) with the San Diego County Tecate cypress groves. The Coal Canyon area is enlarged to the right showing the soil sampling sites as indicated by Roman numerals. Firebreak not to scale.

of conditions undecided or unknown. The Sierra Club filed an appeal with the Orange County Board of Supervisors. It is expected that a lawsuit will follow. Funds will be needed to pursue legal action. Tax deductible checks can be made out to the "Sierra Club Foundation" and marked in the lower left-hand corner, "Angeles Chapter--Coal Canyon Legal Fees."

Send to: Betty Riefsneider
Conservation Coordinator
Sierra Club Angeles Chapter
2410 Beverly Blvd.
Los Angeles, CA 90057
(213) 387-4287

Maps and article by Earl Lathrop. Reproduced by permission of *Aliso*, Rancho Santa Ana Botanic Gardens.

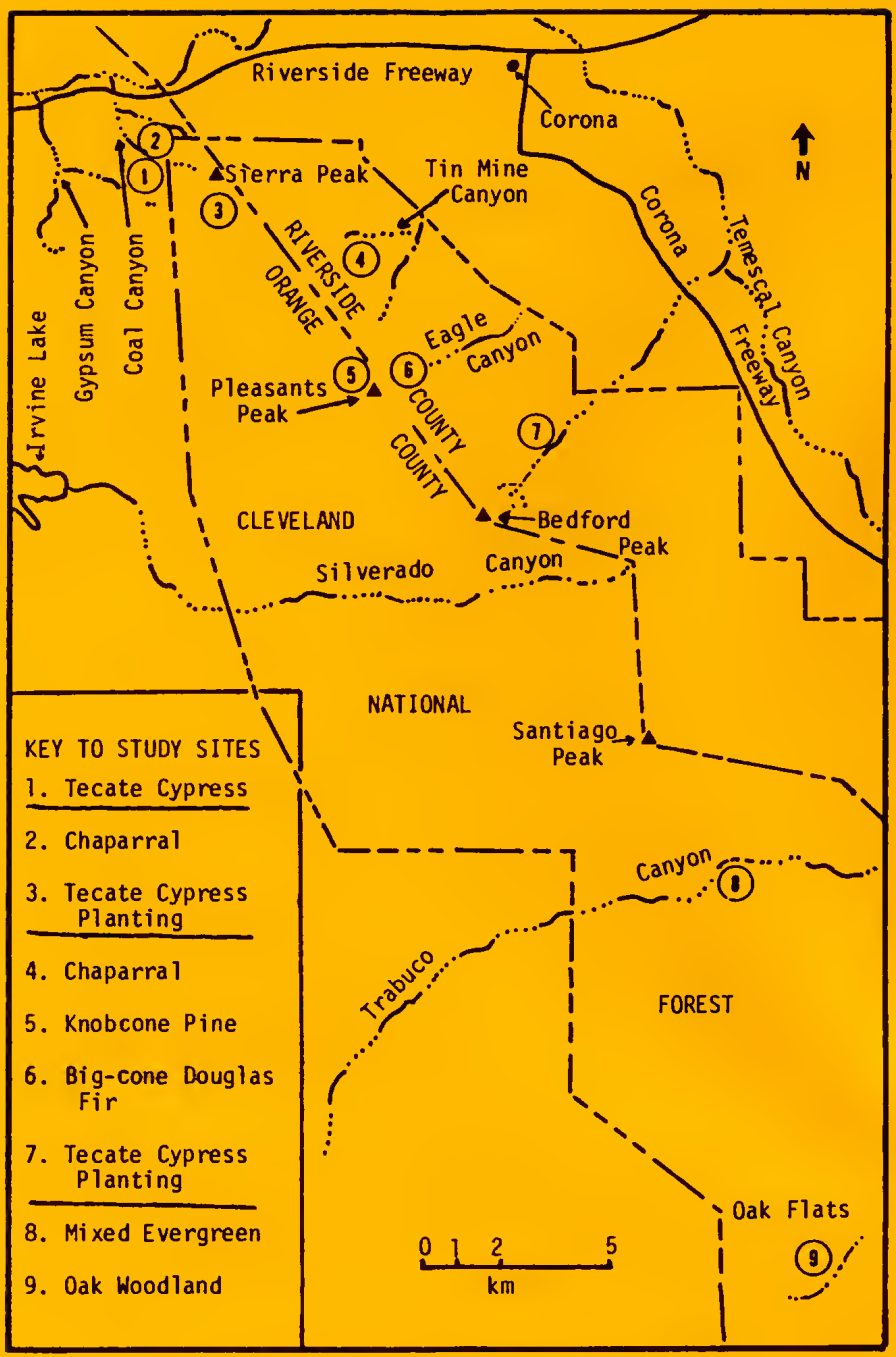

Fig. 2. Map showing location of the Tecate cypress study site in Coal Canyon and adjacent comparison study sites in the Santa Ana Mountains.

PLANT SALE!

The fourth annual California Native Plant Sale, sponsored by Rancho Santa Ana Botanic Garden in Claremont, will be held on *Saturday, November 6, 1982*, from 8 a.m. until 3 p.m. The sale will include selected varieties and species of trees, shrubs, perennial flowers and succulent material known to do well in the soil and unique climatic conditions of southern California. Many of the newer and harder to find varieties of manzanitas and ceanothus suitable for landscaping and groundcover will be available at the sale.

Members of the staff of Rancho Santa Ana Botanic Garden will be on hand throughout the day to give information and advice about the planting and continued care of our drought tolerant native plants. Many of the plants available have been introduced by the garden which has been growing and studying native plants for more than fifty years.

Rancho Santa Ana Botanic Garden is located north of Foothill Blvd. and east of Indian Hill Blvd., on College Ave. in Claremont. Visitors should take the Indian Hill exit from the San Bernardino Freeway (Interstate Highway 10) and go north to Foothill Boulevard, then east to College Avenue; or continue east along Foothill Boulevard from the end of the Foothill Freeway (Interstate 210) to College Avenue.

For further information about the sale, call either (714) 626-1917 or (714) 626-3922.

NATIVE PLANT SEED PROGRAM

Due to last year's overwhelming response, the New England Wild Flower Society is offering for sale once again freshly collected seeds and spores of over 100 native plants.

This program, an adjunct of the Society's world-wide botanical garden seed distribution, is intended to further the use of native plants in the home landscape. The program will continue on a year-to-year basis as long as the demand for the seed remains strong.

Members of the New England Wild Flower Society will receive in January, 1983, a list of seeds available, and all orders must be received by March 1, 1983.

Non-members wishing to receive the Seed Sales List should mail a stamped, self-addressed business (#10 size) envelope by February 1, 1983, to SEED SALES, New England Wild Flower Society, Garden in the Woods, Hemenway Road, Framingham, MA 01701.

NO requests for lists will be honored without the stamped envelope.

ANNUAL POTLUCK DINNER AND PROGRAM

Oldenborg Dining Hall*
Pomona College, Claremont
Saturday, October 16, 1982

Dinner will start at 6:00. After dinner, Al Romspert and Walt Wright will present a short slide program on the vegetation of lowland tropical to upper montaine forest of Costa Rica. Members who have slides of past SCB activities, pick your best 10(±) slides to bring along and share.

As usual, beverage and bread will be provided by SCB. It is suggested that if your last name begins with the following letters, you bring specified dish for self and four additional people: A-I, dessert; J-P, side dish (vegetable, salad, etc.), Q-Z, main dish. Be sure to bring your own table service.

To reach the dining hall, exit from I-10 at Indian Hill Blvd. Go north to 4th St. Turn right and go to College Way. Oldenborg is on the NE corner of College and 4th. Park behind the dining hall. Any questions should be directed to Walt Wright at (714) 641-8820.

SCB books will be available. Please come! This is always a most enjoyable evening.

The October Board of Directors meeting (at 5:15 p.m.) will precede the Pot Luck Dinner.

*Note change in location

FIELD TRIPS

October 2-3, 1982 (Saturday and Sunday)
Butterbread Canyon

Meet at corner of Jawbone Canyon Road and State Highway 14, 19 miles northeast of Mojave, CA, at 9:00 a.m. Bring water and camping gear if staying overnight. Fill up with gas at Mojave. Contact Walt Wright at 714-641-8820 (daytime) or 714-990-9092 or 529-4134 (evenings) for details.

November 25, 26, 27, 28, 1982 (Thanksgiving Weekend)
El Golfo de Santa Clara, Sonora, Mexico

This field trip will cover the huge delta and estuary of the Colorado River at its confluence with the head of the Gulf of California. The tidal range may be 25 feet, producing an extensive region of mud flat and marsh. Sandy beaches and sand dunes form a backdrop for the intertidal habitat. All this will be of interest to botanists and birders. This area is at the end of the road on

a road to nowhere else (the road is paved). It is one of those places that, if you have not been there, now is your opportunity.

Meet at 9:30 a.m. Thursday in the parking lot of the Imperial Irrigation District office, Imperial Ave. (State 111) at 3rd in Calexico. Bring food, water, camping gear, wood for fire (probably very little in the area), camera, binoculars, etc. Call Walt Wright for further information (Day: 714-641-8820).

CROSSOSOMA is published bimonthly (February, April, June, August, October and December) by Southern California Botanists, a non-profit association. Dues are on a calendar year basis. Regular $6.00. Students and Retirees $4.00. Groups $10.00.

We thank all those who have remitted their 1982 dues. All others, please send your checks. This journal can only be sent to members whose dues are current. If the notation "82" does not appear on your address label after your name, our records indicate that your dues have not been paid for 1982. If we are in error, please let us know.

APPLICATION FOR MEMBERSHIP

Those joining SCB in October through December, 1982, are credited with dues paid in full for 1983. Their memberships are effective immediately, they will receive the October, 1982, and December, 1982, issues of *Crossosoma* and will be entitled to discounts on books and admission to the Symposium, etc.

Membership categories are:

____	Student or retired*	$ 4.00
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*This includes membership for the rest of the family.

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Mail check and this form or your letter to:

Membership Chairman
SOUTHERN CALIFORNIA BOTANISTS
1500 North College Avenue
Claremont, CA 91711

COMING 1982 EVENTS (DETAILS WITHIN)

October 2-3	Field Trip, Butterbread Canyon.
October 16	Pot Luck Dinner
October 23	Symposium
November 6	SCB Plant Sale
November 24-28	Field Trip, El Golfo de Santa Clara, Sonora, Mexico

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SOUTHERN CALIFORNIA BOTANISTS

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CROSSOSOMA

SOUTHERN CALIFORNIA BOTANISTS
Rancho Santa Ana Botanic Garden, Claremont CA 91711

Crossosoma Vol. 8, No. 6
Editors: Theodore Mortenson
Geoff B. Smith
December, 1982

FIRE ECOLOGY OF DEERGRASS (*Muhlenbergia rigens*) IN CUYAMACA RANCHO STATE PARK, CALIFORNIA.

by

Earl Lathrop and Bradford Martin

The purpose of this study was to assess the results of prescribed burning in four deergrass sites in the grassland mesas of Cuyamaca-Rancho State Park, eastern San Diego County, California. The grasslands there, which range in elevations from 1220 to 1524 m, show indications of past overgrazing, but many of the meadows have potential for renovation because of the presence of native perennials, including deergrass (Figs. 1 and 2).

Deergrass (*Muhlenbergia rigens* (Benth.) Hitchc., Poaceae) is a native bunch grass typical of meadows and of banks of intermittent streams in valley grassland, chaparral, and yellow pine forests of California (Munz 1974). Bunches of deergrass can be as much as .5 m across at the base and up to 1.5 m high. Older, coarse bunches of deergrass are not palatable to grazers, but the new foliage of younger clumps is very palatable, particularly to deer (Crampton 1974). Older bunches of the grass, however, provide fawning cover for deer, a factor perhaps contributing to its common name. Balls (1962) states that the Indian tribes of Southern California used deergrass extensively in making the foundation for their coiled basket work. A small bunch of grass was bound with a strand of squaw-bush (*Rhus trilobata* Nutt. ex T. & G., Anacardiaceae) to form the coil. The Indians had to collect and use the grass blades and squaw bush stems at just the right stage, not too green yet not too old. We know that North American Indians used fire to facilitate collection and to increase production of useful plants (Sauer 1950; Biswell 1974). It is quite possible that the Cuyamaca Indians burned meadows and woodlands in the vicinity of the park where both basket species occur, to facilitate the use of fresh new growth of deergrass and squaw bush for their baskets.

There are similar benefits to be derived today by burning meadows, as for the Cuyamaca Indians. Heavy grass mats build up in older, unburned deergrass stands, which curtail new growth. Fresh, palatable grass is minimal under these conditions, and fawning cover is diminished as older, tall blades become matted (Walstrom 1976). Agozino (1977) states:

> There appears to be some merit, to the controlled use of fire for restoring some portions of the meadows (in Cuyamaca Rancho State Park), particularly extensive areas dominated by native deergrass.

With this advice in mind, the personnel of Cuyamaca Rancho State Park, with help from the California Division of Forestry, burned five experimental plots in deergrass meadows on East Mesa of the Park (Lathrop and Martin 1982).

Methods

The five burn plots, hereafter referred to as plots A-E, were each approximately .1 ha in area and were burned on the following dates: A) December 11, 1978; B) December 11, 1978; C) December 15, 1978; D) December 3, 1979; and E) April 4, 1980. Plot A was burned at a high intensity of between 148-204°C. The remaining plots were burned at a low intensity, approximately 93°C. Both the high and low intensity burning removes nearly all the above ground grass foliage, particularly for deergrass where the dead foliage within the clump, approximately 50%, helps to carry the fire. High intensity burning, in addition, tends to destroy the adventitious buds in the ground level caudex, buds which are needed for recovery.

Measurements were taken at each study plot during June and July, 1980, primarily for the purpose of testing recovery of the deergrass. Foliar cover (percentage of ground covered by foliage) of this dominant grass species was determined by use of the point frame (Phillip, 1959). An average of 300 point samples were taken in the burned and control (unburned portions of the meadows) areas of plots C, D, and E. In addition, percent basal area and density (no/m^2) of deergrass clumps were determined by the quadrat method (Cox 1980) in the same plots. Post burn measurements and analysis of plots A and B were done by personnel of Cuyamaca Rancho State Park (Agozino 1980 personal communication).

Results

The high intensity burn of plot A showed a marked decrease of deergrass with an almost complete shift to sedges (*Carex* spp.) and rushes (*Juncus* spp) in the wetter portions of the meadow. Plot B, immediately adjacent to plot A and burned at a low intensity,

Fig. 1. View showing deergrass clumps in a meadow on East Mesa of Cuyamaca Rancho State Park, California.

indicated a significant increase of deergrass cover and reduction of sedges and rushes, compared to the control.

Plot C, measured 1½ years after the burn, indicated that basal area of individual deergrass clumps, which had to recover from basal buds in caudices because all above ground foliage was destroyed in the fire, was reduced significantly. However, density of the fresh clumps was 3 times greater per M2 than the older control bunches, resulting in an increase of live foliar cover of 145 percent in the burn plot, compared to the control. Plot D, measured 7 months following the burn showed similar results as in plot C with an increase of deergrass clump density but with smaller basal areas per clump. Foliar cover of the species had recovered 51% of the control. For comparison, the total foliar cover of all species in the meadow burn plot including a dominant annual fescue grass (*Vulpia myuros* (L.) K.C. Gmel.), had recovered 78% compared to the control.

Plot E, burned April 4, 1980, had the shortest recovery period to measure, but showed a very rapid regrowth compared to the other plots. Foliar cover measurements with the point frame were made on a monthly basis for three months immediately after the burn. Comparing the foliage cover the the burn plot with the control, deergrass recovered 21% in May, 1980, 90% by June, 1980, and 143% by

Fig. 2. View of plot E taken one month after the April 4, 1980 burn showing removal and thinning of deergrass bunches.

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Please complete your ballot and mail before December 30, 1982

THANK YOU FOR VOTING!

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July. Basal area of clumps and density of clumps of the species showed the same results of burning as plots C and D.

Conclusions and Significance

Results of the high intensity burn plot of A December 11, 1978, appear to indicate that the extreme heat may destroy the buds in the caudex of the deergrass, not permitting it to recover, at least not after two seasons. Sedges and rushes, lacking immediate competition, appear to be able to increase significantly where soil moisture is not limiting. The low intensity burn at the same site tended to increase the vigor and permitted spread of the deergrasses by burning away a lot of the build-up of dead material in their caudex without destroying their buds. The light intentsity burn of plots C, D, and E also showed increased vigor in the stand by thinning of the bunches and spreading, as indicated by fresh new deergrass bunches appearing in the periphery of the burn site. These burns clearly demonstrate the ability of deergrass to recover very rapidly after a light intensity fire. Removal of excess buildup of dead grass as a result of the fire is perhaps the key to the increased productivity of fresh deergrass blades. In all instances, burning tended to increase the number of clumps and reduce the size of each clump. Although fawning cover for deer may be temporarily removed by burning, the resultant new growth is more palatable compared to old growth and the fresh blades are soon dense enough to hide fawns.

The relatively rapid recovery of deergrass in plot E might have been partly due to the time of year the plot was burned, April. At that time of the year fire would remove many of the competitive forbs and annual grasses, particularly the dominant European fescue, *Vulpia myuros*. Perennial grasses have the advantage under these conditions because the buds in their caudices are not destroyed by light-intensity fires and their competition is removed at a critical regrowth period.

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Earl Lathrop is a Professor in the Department of Biology, Loma Linda University. Bradford Martin is a graduate student in the department.

MILDRED DAVIS SCHOLARSHIP

The Southern California Horticultural Institute is offering a $1500 annual, renewable Mildred Davis Scholarship to a student with a strong interest in ornamental horticulture.

The recipient must be enrolled full time as an upper division or graduate student in botany, horticulture or an allied field.

Factors to be considered in selection:

1. Horticultural interests and accomplishments
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3. Financial need
4. How the award will be used (tuition, living expenses, special projects, books, etc.)

Complete applications must be received by March 26, 1983. An application form may be obtained from Southern California Horticultural Institute, P.O. Box 266, Woodland Hills, CA 91365.

The purpose of the SOUTHERN CALIFORNIA BOTANISTS is the study, preservation and conservation of the native plants of California; and the education of the public to the value of the native flora and its habitats. It is a non-profit association formed in 1927.

Membership benefits include: Various field trips throughout the state led by competent field botanists and biologists; a yearly plant sale featuring native California species; an annual symposium on various aspects of the California vegetation; the SCB journal, CROSSOSOMA (published February, April, June, August, October and December); discounts on botanical and natural history books.

FIELD TRIPS

December 11, 1982 (Saturday)
Dr. Samuel Ayres' Garden and Nursery of Australian Plants

Meet at 9:30 a.m. at the Ayres' residence, 4665 El Camino Corto, La Canada. North on Glendale Freeway #2 to end, take off ramp marked "Foothill Blvd." Right on Foothill two blocks to El Camino Corto, then north to residence. OR, Freeway #210 from Pasadena, West to Angeles Crest Highway, left to Foothill, right to El Camino Corto. Picnic lunch at Descanso Botanical Garden.

January 22-23, 1983 (Saturday and Sunday)
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January 22-3, 1983 Santa Monica Mountains